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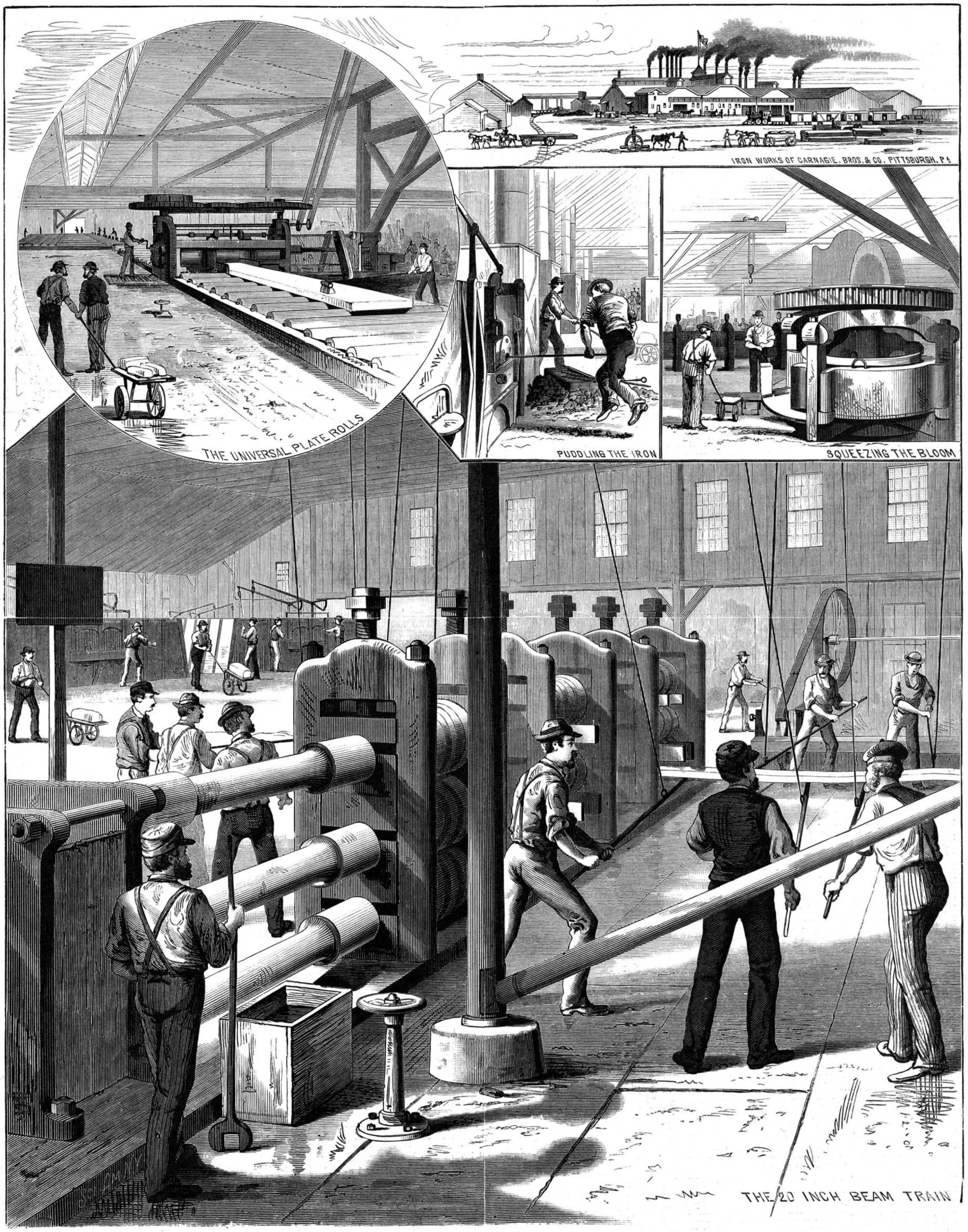
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THE UNIVERSAL PLATE ROLLS
PUDDLING THE IRON
SQUEEZING THE BLOOM
THE 20 INCH BEAM TRAIN

THE UNION IRON MILLS, CARNEGIE BROTHERS & COMPANY, PITTSBURG, PA.—[See page 149.]

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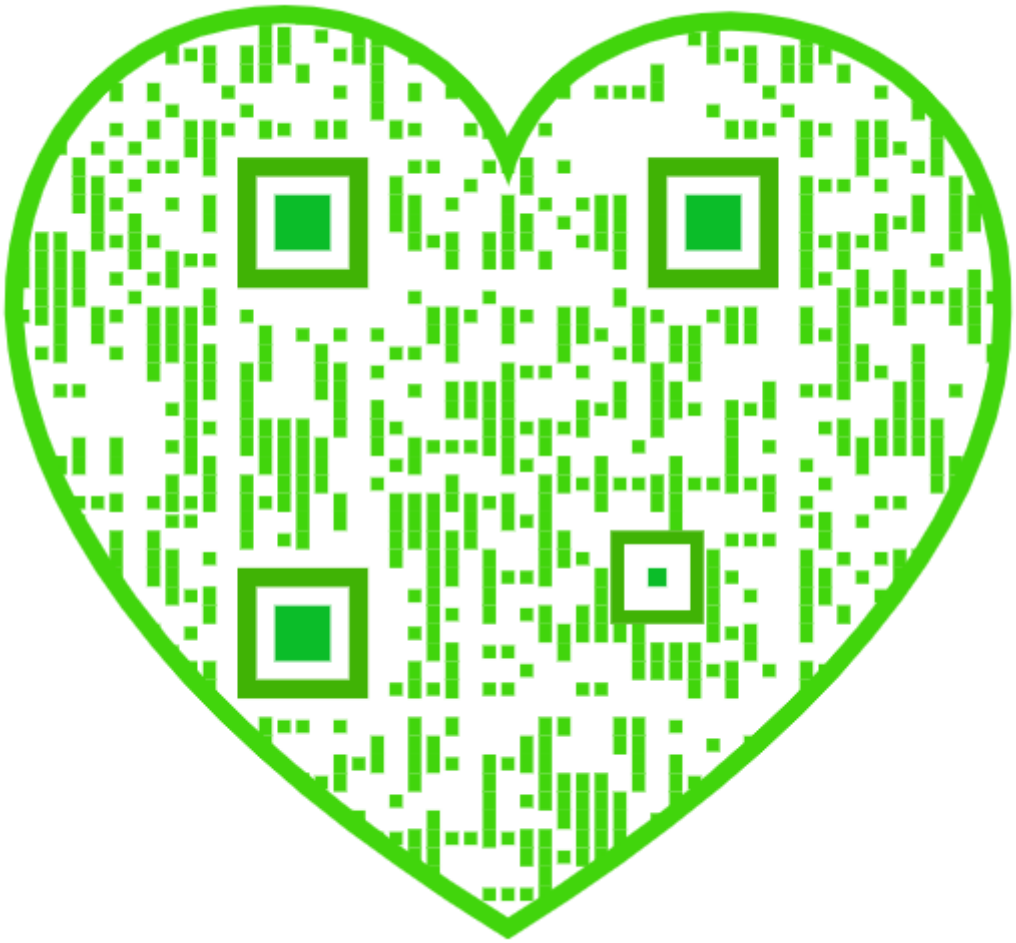

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NEW YORK, SATURDAY, MARCH 6, 1880.

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THE PROPOSED NEW PATENT LAW.

On the 9th February the committee on the Revision of the Laws of the United States House of Representatives, on a motion to suspend the rules, succeeded in rushing through that body a bill "To regulate the practice in suits brought to recover damages for the infringement of patents." The bill is a very different one from that which was so elaborately discussed previous to its passage by the Senate and defeat in the House last year, and, coming as it did from the Committee on the Revision of the Laws, instead of from the Committee on Patents, took everybody by surprise; it was passed without any consideration whatever, but few members understanding its provisions, and only 126 voting, when there are 293 members in a full house.

The extraordinary haste with which it was put through was such that, we understand, the bill had not even been printed when it passed the House. The official text is as follows:

AN ACT to regulate practice in suits brought to recover damages for infringement of patent.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That hereafter in any suit brought in any court having jurisdiction in patent cases for an alleged use or infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant in such suit purchased the same in good faith for his own personal use from the manufacturer thereof, or from a person or firm engaged in the open sale or practical application thereof, and applied the same for and to his own use and not for sale, if the plaintiff shall recover a judgment for five dollars or less, as damages, the court shall adjudge that he pay all costs of suit; and if the plaintiff shall not recover the sum of twenty dollars or over, the court shall adjudge him to pay all his own costs, unless it shall also appear that the defendant at the time of such purchase or practical application had knowledge or actual notice of the existence of such patent: *Provided,* That nothing contained herein shall apply to articles manufactured outside of the United States.

Passed the House of Representatives February 9, 1880.
Attest: GEORGE M. ADAMS, CLERK.

It certainly seems very ridiculous, after the many years during which some of the ablest members of both Houses of Congress have been unsuccessful in perfecting a patent bill which would meet all objections, to pretend that *this* measure has been brought forward, and thus "railroaded" through the lower House, for the "protection of farmers" from the extortions of patentees, which is now the principal point urged in its favor. "Farmers" are not generally credited with having the influence at Washington which can accomplish such results, and the manner in which the bill was passed, as well as the promptitude with which this justification of its provisions is furnished, carry conclusive proof, if any were needed other than that afforded by the bill itself, that the work is only one other "neat little job" of a well-paid lobby. Already before those most interested have had an opportunity to judge of the merits of the bill, a leading New York daily has some cut-and-dried arguments to urge in its support, put in what is judged to be a popular way, which may be summarized as follows: That sharpers have succeeded in imposing upon many people—especially farmers—by selling them what the seller did not own, or had no right to sell; that the patent laws are complicated, and common people cannot be expected to understand them, and that, therefore, the patentee should help make good to an infringer any loss which the latter may suffer from throwing away his money on swindlers.

The foundation of our patent system rests only on the constitutional provision that "Congress shall have power to secure to inventors for limited times the *exclusive* right to their discoveries." Congress, at an early day in our history, enacted laws in pursuance of this provision, which, although they have been many times changed, have always retained this distinctive feature: they give to the inventor the 'exclusive" right to his inventions. Congress may constitutionally enact that patents shall hereafter be "limited" to a year, or six months only, or may repeal the patent law entirely; but plainly any right at all which a patent gives must, according to the Constitution, be an "exclusive" one, and all patents so far issued have "secured" such exclusive right, so far as the law is concerned. This bill would destroy the inventor's exclusive right, for it makes the conditions so favorable for infringers, and bears so inequitably upon patentees, that it would be utterly impossible for thousands of the latter to maintain their rights. That ignorance of the law is never a bar to punishment for its violation runs through all our jurisprudence, and every man is expected to know what the law is; but here we are, it seems, to have an exception, in the case of a man who wishes to use a patent without paying the patentee, for which this bill practically offers a premium. Another constitutional objection is also to be found in that provision which prohibits the passage of any law "impairing the obligation of contracts." The inventor obtaining a patent obligates himself to do, and must perform, many things, often at great cost, in order to fulfill the conditions imposed, and the law says he shall have in return certain benefits; when the patentee has fulfilled the conditions, and invested large sums of money, under the rights with which he has been legally vested, to arbitrarily deprive him of the benefits would be practically a direct violation of this constitutional provision.

That there have been thousands of people swindled—not only farmers, but men of all classes—in buying articles manufactured by infringers of patents, cannot be denied. One would think that the remedy for this evil should be sought in legislation to more certainly detect and more effectually punish the criminal; but this bill cannot fail to act as a premium for those who have a turn for this sort of enterprise, as it virtually confiscates to their use the property of thousands of patentees. The law holds, in regard to all other kinds of property, that the purchaser is bound to exercise due care and discretion to see that the seller is the owner of or has the right to sell that which he offers, without which there can be no *bona fide* sale; but this bill not only relieves the purchaser of a patent from any obligation to exercise such care and diligence, but actually lays a fine upon the rightful owner for establishing his legal title in the courts. We do not for a moment believe that the bill in its present form can pass the Senate; but if it should be amended there, and go back again to the House, we trust it will then be fully discussed, with such ample explanation of its provisions as the great importance of the subject calls for; if this innocent measure "to regulate practice," etc., comes up again in this way, we shall have no fears of its being then rushed through so precipitately, notwithstanding the urgent reasons which the "Third House" may adduce for prompt action—on behalf of "the farmers," of course.

APPROXIMATE ECONOMY OF GAS AND ELECTRIC LIGHTING.

Taken by itself a cipher is an innocent thing and amounts to nothing; but its presence or absence in a series of figures sometimes makes an important difference in the summing of results. We presume that most of our readers must have noticed the errors resulting from the omission of ciphers in the article in our paper of February 21, under the above heading. As the subject is one of interest we think the best way is to republish the article, corrected as it should have been printed, and therefore give it as follows:

It is not in every place or position that the electric light can be employed in lieu of gas; but under some circumstances, for example, in spacious apartments, where large numbers of gas lights are used, the electrical method of lighting may now be adopted with satisfactory success. Under such conditions, and with gas costing the excessively high prices that we are accustomed to pay, the superior economy of electricity over gas has been conclusively settled on this side of the Atlantic. We might cite various examples, but for our present purpose one will be enough, to wit, the Riverside Worsted Mills, Providence, R. I., where the Brush electric lights have been in regular use for about one year past—long enough to determine approximately their actual expenses and merits.

In one portion of the above mills 1,000 gas lights were used, each of 15 candles intensity, yielding an aggregate of 15,000 candles, and costing $12.25 per hour to run them, or $\frac{82}{1000}$ of a cent per candle per hour.

We are not informed as to the exact cost of the gas per 1,000 cubic feet, but we figure it to be $2.45.

In lieu of the above 1,000 gas lights 80 electric lights were substituted, each of 2,000 candles intensity, yielding an aggregate of 160,000 candles, and costing 80 cents per hour to run them, or $\frac{1}{2000}$ of a cent per candle per hour.

If we have not been misinformed as to the above estimates of costs and intensities, it would appear that gas lighting, at the mills named, was over a hundred and sixty times more costly than electric lighting, quantity of light produced being considered.

It may not be uninteresting briefly to compare the probable economies of Mr. Edison's new system of lighting with the foregoing results.

Mr. Edison's method has, to be sure, as yet only reached the stage of experiments. But it must be remembered that his trials have been made on an extensive scale, with full-sized electrical machines and apparatus, expressly with a view to show and determine what the practical introduction of the invention, wherever used, would accomplish. We have his authority for saying that the generous sum of one hundred thousand dollars in cash was placed at his free disposal, by his associates, to be used as he saw fit for these grand experimental demonstrations.

In a word, Mr. Edison's plan is to furnish small electrical lamps, each having the intensity, he tells us, of an ordinary gas light of fifteen candles, burning five cubic feet of gas per hour. He states that he gets ten lamps, or 150 candles, of light per hour per horse power of engine; and that each of his new electrical machines furnishes 750 candles of light and requires five horse power to drive it.

Applying the Edison system to the Riverside Mills and to the replacement of the 1,000 gas lights, we have the following approximate results:

Number of Edison lamps required, 1,000; number of Edison machines required to run the lamps, 20; engine power needed, 100 h. p. Approximate cost of the Edison plant, $16,000. Approximate cost of running the same, delivering 15,000 candles of light per hour, including 6 per cent interest on the plant, $1.66 per hour, or $\frac{11}{1000}$ of a cent per candle per hour. This estimate allows no royalty to the owners of the patents. Thus the approximate cost of gas lights at the Riverside Mills is seven and a half times more than the same quantity of light would be under the Edison system. And the cost of the Edison system would, approximately, be twenty-two times more than the cost of the same quantity of electrical light as delivered by the present Brush machines. Side by side the fractions stand as follows:

Approximate costs of lighting per candle per hour:

Gas lights.	Edison lights.	Brush lights.
$\frac{82}{1000}$ of a cent.	$\frac{11}{1000}$ of a cent.	$\frac{1}{2000}$ of a cent.

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THE CERTIFICATION OF TIMEPIECES.

At the recommendation of the board of managers of the Winchester Observatory of Yale College, the corporation of the college has established a horological bureau for the rating of watch movements and other timepieces, and the prosecution of researches calculated to aid in the construction of refined apparatus for the measurement of time.

For carrying on this work the bureau has been furnished with a large number of instruments of precision, and arrangements have been made with the Safe Deposit Company of New Haven for the erection within their steel vaults of the necessary apparatus and closets for safely keeping the watch and chronometer movements while being tested. These closets comprise a refrigerator (40° Fah.), provided with zinc cases for 100 movements surrounded by chemically dried air; an oven (90° Fah.) of equal capacity, heated by coils of pipe carrying hot water; and closets of ordinary temperature (65° to 75° Fah.), having a capacity of 800 movements.

Eight classes of certificates will be issued with timepieces which have been submitted for trial, stating in detail the results obtained with each particular movement. The cost of testing or certifying ranges between $1 and $4. While under examination the movements will be carefully guarded by the Safe Deposit Company. They are not to be opened or in any way tampered with for any reason whatever, and will not be handled except by trained observers.

First-class movements will be subjected while rating to variations of position and temperature as follows: Dial up; twelve days at ordinary temperatures, one day in the refrigerator, and one day in the oven Dial vertical; fourteen days pendent up, two days pendent right, and two days pendent left. Dial down; two days. Dial up; eight days. The variations of rate under each of these conditions will be given in the certificate. For lower grade certificates the tests are less protracted.

The astronomer in charge of the bureau, Mr. Leonard Waldo, will supply blanks and information as to the conditions of issuing certificates; and in his annual report he will publish in detail the rates of such timepieces in the various classes as may show progress in the horological art.

The results of such work cannot fail to advance the standard of watch manufacturing. It will also enable watch buyers to know precisely what they are getting, an advantage which they will not be slow to appreciate.

IMPORTANT DECISION BY THE U. S. CIRCUIT COURT —THE PAGE ELECTRICAL PATENT SUSTAINED.

The suit of the Western Union Telegraph Company against the Holmes Burglar Alarm Company, has just been decided in the United States Circuit Court in this city, Judge Blatchford presiding, in favor of the plaintiffs. If this decision is sustained by the United States Supreme Court, the Western Union Telegraph Company will be the possessors of one of the most gigantic of modern monopolies. The company will have the control of nearly all telegraph and electrical instruments, telephones perhaps excepted. In fact from the present time onward, until the Supreme Court gives a contrary decision, the Western Union Telegraph Company are masters of the field. By this decision, it may almost be said, that the exclusive right to use electricity for commercial and domestic purposes is taken from the public and transferred to the hands of the above corporation. This result is due to the wicked practice of private legislation in which Congress too often indulges. The injury done in this way to the public interests is incalculable.

The history of this case is briefly as follows:

Many years ago, dating back to 1836, it is said, Charles Grafton Page, of Washington, D. C., first made electrical inventions, among which, it is alleged, was an electrical coil and armature, which had a set screw applied to adjust or regulate the throw or motion of the armature. Without this little set screw, or its mechanical equivalent, it would be practically impossible to work an ordinary telegraph instrument, signal apparatus, burglar alarm, or electric motor.

Page suffered his invention to go into public use without taking steps to apply for a patent, and under the general patent laws, in consequence of his neglect, lost all right to a patent.

But in 1854 it appears to have occurred to him that perhaps at some future time or another he might coax Congress to grant a special act in his favor, and as preliminary thereto he filed an application for a patent, which under the law was refused examination, on the ground that the invention was public property, and he himself was an examiner in the Patent Office. Page was, in fact, the examiner of electrical patents, and for many years it had been his official duty to issue hundreds of patents, all of which contained his alleged original invention.

In 1868 Page was taken sick, and when it appeared that he had not long to live, Congress, at the instance of his friends, with a view to assist his family, passed the following unwise and sweeping act:

Chap. XXXII.—An act to authorize Charles Grafton Page to apply for and receive a patent:

Be it enacted by the Senate and House of Representatives of America, in Congress assembled, that the Commissioner of Patents is hereby authorized to receive and entertain a renewal of the application of Charles Grafton Page for letters patent for his "induction apparatus and circuit-breakers," now on file in the United States Patent Office, including therewith his circuit-breakers described by him prior to said application; and that if the Commissioner shall adjudge the said Page to have been the first inventor thereof, he *shall issue* to him a patent, *which patent shall be valid* notwithstanding said Page's invention may have been described or in use prior to said applicatian, and notwithstanding the fact that said Page is now an examiner in the United States Patent Office· *provided*, that any person in possession of said apparatus prior to the date of said patent shall possess the right to use, and vend to others to use, the said specific apparatus in his possession, without liability to the inventor, patentee, or any other person interested in said invention or patent therefor.

Approved March 19, 1868.

On the passage of this act the Commissioner of Patents, in accordance with the mandates of the special law, caused the examination to be made, and then ordered the issue of a patent, which was dated April 14, 1868. Dr. Page died May 5, 1868.

It was pretty generally doubted at the time of the passage of the law and the grant of the patent, whether the latter could ever be sustained in the courts, and among the greatest doubters were members of the Western Union Telegraph Company. However, as there would be a possibility of litigation against them in any event, by the holders of the Page patent, they concluded that the safest way was to purchase an interest in the patent enough for their own protection, and for a small sum they acquired such interest from the heirs of Mr. Page. Subsequently, it appears, the Western Union Company acquired the substantial control of the patent, and in 1874, after careful preparation, brought this suit against the Holmes Burglar Alarm Company as a test suit.

Judge Blatchford's decision, we understand, sustains all the points made by the plaintiffs. It was urged in the case that the Special Act of Congress, in 1868, was unconstitutional, as the apparatus had been in use so long, but the decision is that the Special Act was constitutional. The validity of the entire patent was affirmed, the claims specifically sustained in the decision being the eleventh, twelfth, and thirteenth, and here is where the great importance of the case appears. These three claims are:

11. The adjustment of the retractile force of an automatic circuit breaker, as set forth.

12. The combination of an electro-magnet armature and adjustable retractor.

13. Adjusting or regulating the length of vibration of the armature of an electro-magnet by means of a set screw or any mechanical equivalent for substantially the same purpose, substantially as herein set forth.

We intend in a future number to discuss the subject further and present abstracts from the Judge's decision, which, we are informed, covers fifty pages, and is a very formidable and exhaustive document.

THE INSPECTION OF SMALL STEAMERS.

In his report for 1879, the Supervising Inspector General of Steam Vessels took notice of the excessive license fee for steam yachts and other small vessels using steam power, and suggested that a charge of $5 would be enough for the annual inspection of such craft.

The objection to the present fee of $25 is two-fold; it is out of proportion to the size and importance of the vessels paying the license, being as much as is charged for steamers of 100 tons burden, and it is practically prohibitory to a large class of men who would otherwise build and use such vessels for pleasure or profit. There are thousands of miles of inland waters, small lakes, rivers, bayous, and the like, which would in the aggregate play an important part in furthering inland commerce, if small steamers could be used without having to pay an inspection tax large enough to swallow up all or a great portion of the profits of such use. Thousands of farmers, cotton growers, fruit growers, and others, might, and we are confident would, find such vessels an easy and profitable means for conveying produce to local centers of distribution and consumption, to the great advantage of local and general traffic, where ordinary cartage is impossible or unprofitable This with the great extension which would be given to the employment of steam power for propelling pleasure boats by a reduction of the inspection fee could not fail to give a great impetus to the manufacture of small boilers and engines, and to their adaptation to many lines of domestic and productive work. Already the limited use of steam for small pleasure yachts has given rise to many inventions and the development of considerable industrial establishments. The very important torpedo boat of Herreshoff may be instanced as one of the indirect fruits of the manufacture of small marine engines; and there is no telling what other inventions of radical importance might not result from the lifting of the practical embargo which an excessive license fee has hitherto laid upon the general use of small steamers.

It is gratifying to note that a bill has been introduced in Congress to carry out the Inspector General's recommendation. Its passage would be altogether beneficial.

Another Comet.

The Smithsonian Institution has received from the Astronomer Royal of England the announcement of the discovery by Gill, at Cape Town, South Africa, on February 12, of a comet in 8 hours 58 minutes right ascension, 12° 31′ north declination, with a daily motion of 2° 35′ in right ascension and 20′ south.

ARTIFICIAL DIAMONDS.

A new dispatch from London states that Professor Maskelyne, of the mineral department of the British Museum, announces the production of artificial diamonds by J. Ballantine Hannay, of Glasgow. Tests by Prof. M. leave no doubt that the crystals are diamonds. In our SUPPLEMENT, No. 216, Feb. 21, we gave an account of the production of artificial diamonds by R. S. Baxter, of Dundee, whose specimens are also positively identified as diamonds. The MacTear crystals, it will be remembered, were proved not to be diamonds.

A NEW METEORITE.

Following closely upon the Estherville, Iowa, meteorite of May, 1879, comes the finding of another lost celestial body, this time in Alabama. In 1873 a heavy mass of metal was found by John F. Watson while plowing on a newly cleared piece of land near Chulafinne, Cleberne county, Ala. Among many early speculations as to its nature, some thought it to be bog iron ore, as there are deposits of this ore in the vicinity; others thought it might be native iron. Mr. Watson, to test (?) it, had a small piece cut off by the village blacksmith and forged into a plow point, and had also some horseshoe nails made. It being so easily wrought tended to confirm the native iron theory. It is well known among scientists that terrestrial iron is of extreme rarity, being found only in few basaltic rocks, and then in very inconsiderable quantities. During the seven years following the discovery its real nature was unsuspected and not recognized until revealed in the following manner:

Mr. W. E. Hidden, an expert mineralogist and attaché of Mr. Thomas A. Edison, while in this region last November prospecting for rare minerals, met with ex-Governor W. H. Smith, of Alabama, and heard from him the facts as above stated. This aroused his curiosity, as his knowledge of mineralogy convinced him that in view of the facts as stated, the several hypotheses were incorrect, and that the mass of metal was of meteoric origin and not an ore of iron.

After a considerable outlay of time and money it was finally brought to New York city, and is now in Mr. Hidden's cabinet, which contains three other undescribed meteorites from the Southern States, collected within a year, this one being the largest and of most interest.

Originally it was reddish brown in color and incrusted with scales of rust, which fell off while being heated in the forge. It now weighs 14·5 kg. (31 lb.), about 1·5 kilos having been cut off to make the plow point and horseshoe nails as stated. Its shape is somewhat triangular, the three diameters being each about 25 cm.; it has an average thickness of 6 cm.

A fine metallic surface was readily obtained by filing, which, polished and etched with nitric acid, developed with marked perfection the Widmannstätten lines, which is the convincing proof of its meteoric origin.

A careful analysis by J. B. Mackintosh, M.E., of Columbia College, shows it to be beyond a doubt a meteorite, and of the usual iron-nickel alloy variety.

The quick oxidation of meteorites in our atmosphere, and its being found at only a slight depth from the surface, would warrant placing the date of its fall not later than twenty-five years ago. This wanderer through space, which has strayed from its path and is now on an endless visit to us, will be placed for a short time on exhibition at Tiffany's, Union Square, New York city. This meteorite must not be confounded with the famous Claiborne, Ala., meteorite, which latter, it will be remembered, did not show the Widmannstätten figures, and contained besides an unusual percentage of nickel.

The particulars of this new meteorite are from an interesting paper lately read by Mr. Hidden before the Academy of Sciences in this city.

The American Society of Mechanical Engineers.

A new professional organization, the American Society of Mechanical Engineers, was born in this city February 17. Hitherto American mechanical engineers have had no national society; and this branch of the engineering profession has lacked in consequence the mutual aid and professional coherence which has characterized the departments of civil and mining engineering, whose powerful associations have proved so beneficial to the members of them.

Accordingly, by invitation of Professors Thurston, Sweet, and other prominent mechanical engineers, some thirty gentlemen of eminence in the profession, from most of the Middle and Eastern States, met as above stated to take the preliminary steps for organizing a national society. Letters were also read from a dozen or more prominent engineers encouraging the project. The meeting was called to order by Professor John E. Sweet, formerly of Cornell University, and Messrs. A. L. Holley and Samuel S. Weber were chosen chairman and secretary.

The object of the society, as set forth in the original draught of the by-laws and rules for the government of the association, is to enable mechanical engineers to meet and compare notes, and to facilitate the interchange of ideas respecting improvements in the various branches of mechanical science by the publication of papers, etc. The members are to be divided into four classes—regular members, associates, honorary members, and junior members. The initiation fees are fixed at $15 and $10, and the annual dues $10. Payment of $150 will entitle eligible candidates to life membership. Seven years' practice as mechanical engineer is a condition of membership, provision being made in junior membership for such as have served for a shorter period.

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HYDRAULIC RIVETING.—TWEDDELL SYSTEM.

The increased use of wrought iron, and especially of riveted wrought iron work in construction, calls for convenient and efficient rivet driving machines. The system of hydraulic riveting machines, invented by Mr. Ralph H Tweddell, of London, England, has been extensively introduced in England, on the continent of Europe, and to some extent in this country. Mr. Tweddell's machines are made either portable or stationary, and many ingenious arrangements have been contrived suited to various kinds of rivet driving. In the early power rivet driving machines the riveting die was moved back and forth a fixed distance by a crank, cam, or toggle joint movement, and the work done was not of necessity uniform, inasmuch as variation in size or length of rivet, thickness of the iron plates, or size of the holes to be filled, caused this, at all times equal, motion of the riveting die to

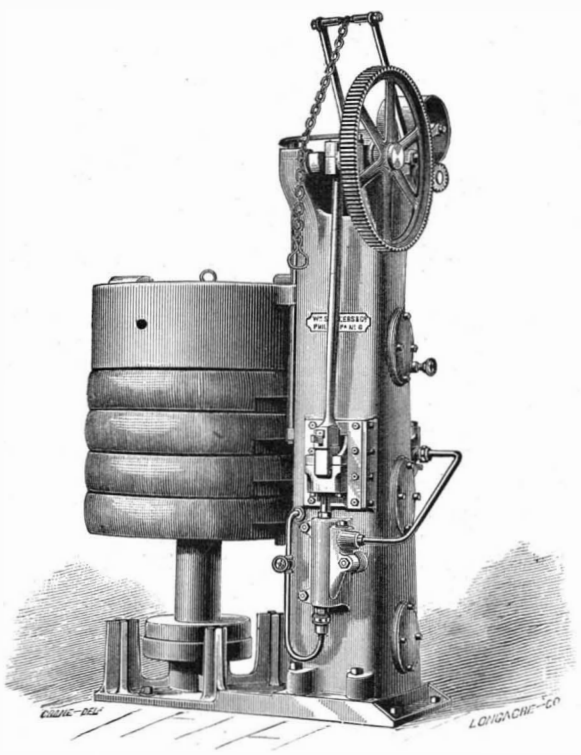

Fig. 1.—PUMP AND ACCUMULATOR.

compress either too much or too little, as the case might be. Direct acting steam riveting machines next came to be used, and with them equal work is done, even with very considerable variation in both rivets and holes, so long as the boiler pressure actuating the machine is kept uniform.

Direct acting steam riveters are not readily made portable, on account of the low pressure of steam and the consequent large size of the cylinder required. Thus, steam riveting machines for boilers are made with cylinders from 31 inches to 42 inches diameter, according to the work required. Steam used is generally 70 to 80 pounds pressure to the square inch. Hydraulic riveting machines with cylinders 6¼ inches diameter, and with water under a pressure of 2,000 pounds to the square inch, will do the same work as a steam riveting machine with 36 inch cylinder, with 60 pounds of steam. The

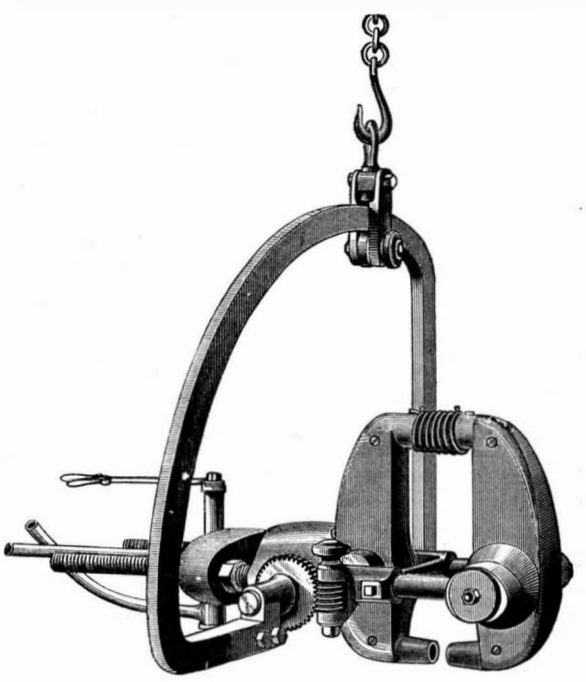

Fig. 2.—SUSPENDED RIVETING MACHINE—SIDE VIEW.

important feature of Mr. Tweddell's system of riveting machines, apart from the ingenious arrangement of the special machines, lies in the use of an accumulator, in which the water is stored under pressure, and from it admitted to the cylinder of the machine, where its power depends upon the load on the accumulator plunger; by adjusting the load on the accumulator to suit the size of rivet to be driven, the utmost uniformity is insured in the riveted work.

The outfit required for the Tweddell system of hydraulic riveting consists of a pump and accumulator and the machine proper; the latter may be either stationary or portable. We give (Fig. 1) a cut of the pump and accumulator. In this the pump is double acting, operated by crank motion. It takes its water from a reservoir in the upright; the return water, re-entering the reservoir, passes through a mass of sponge to filter it. The water on its passage from the pump to the accumulator goes through a relief valve on the back of the upright. This valve is so constructed and controlled by the motion of the accumulator as to relieve the pump from work without stopping its motion when the accumulator is full, and starts it to pumping into the accumulator as soon as the accumulator weight has descended a short distance. When the valve is open the water under pressure in the accumulator is shut off from the pump; the pump relieved from pressure draws water from the reservoir and forces it back into the same reservoir, maintaining the action without strain, but is ready to resume its work when required. When the relief valve is closed the pump forces water directly into the accumulator.

The accumulator holding enough water for, say, two strokes of the riveting machine, is soon filled by the pump; when full the pump must either be stopped or the water be discharged elsewhere. To stop the motion of the pump each time the accumulator fills involves its being started again as promptly when required. This is not readily done, and risks the loss of water and entrance of air into the pump chamber, while standing. To continue to run the pump and discharge under a safety valve, involves an expenditure of power when no work is being done. The arrangement employed maintains the motion of the pump ready for immediate action, and yet relieves it from strain when not required to do work.

The accumulator is arranged with weights suspended below the main casting, so made as to be readily released from it in order that the pressure may be adjusted to the work being done. Each weight represents a pressure of 250 pounds per square inch on the ram of the riveting machine. The maximum pressure obtainable when all weights are in place is 2,000 pounds per square inch, and it may at will be made 1,000, 1,250, 1,500, 1,750, or 2,000 pounds per square inch.

For bridge work construction in the shop the pump and accumulator are placed in any convenient position, and the water under pressure is carried from the accumulator through jointed or flexible pipes to the portable hydraulic riveting machine suspended from an overhead carriage.

The work, resting on trestles, remains stationary; the machine is moved along it from rivet to rivet to be driven. The riveting machine itself is adjustable within a hanging bail, and can thus be made to present itself properly to seams, horizontal, vertical, or oblique. In Figs. 2 and 3 we show the portable riveter in these positions. The dies are carried by levers, and the hydraulic cylinder acts upon levers of the third order, so proportioned that the die pressure is two-thirds of the cylinder pressure.

The overhead carriage, which is usually applied to these machines, has a motion of 50 feet in one direction and of 6 feet at right angles to the first motion, so that the riveter can act anywhere over a space of 50x6 feet of the shop floor. In this space the work rests on trestles, and the riveting machine is moved along or around it.

One man raises or lowers the riveter and moves it along the work. The rivet driver adjusts it to the work and closes the dies by a motion of the valve lever; on beam work as many as 10 to 16 rivets can be driven per minute. For boiler work the riveting machine is made stationary, as shown in Fig. 4, and the work is presented to it hanging from a suitably arranged crane.

Sometimes for deep girder work a portable machine, similar to the stationary one, is suspended upside down from a hydraulic crane, and made to move from rivet to rivet over the deep girder, all the motions being controlled by the operator.

Hand riveting is a trade of itself; on boiler work the same number of men form a gang to drive one rivet at a time as is required to run a hydraulic riveting machine and to operate the hoisting machine. With hand riveting the work stands still and the men move about it. With the stationary riveter the entire boiler or other construction must be taken to the machine and moved about it. The men required to work the hydraulic riveter are not trained riveters. In riveting boilers by power the necessity of holding the rivet until it is cool limits the operator to five rivets per minute, to do good work. If it were not for this reason ten rivets could easily be driven per minute; but even with this restriction it is claimed that the comparison between hand and power riveting in the same shop is ten to one in favor of power riveting in reference to the number of the rivets driven, taking into consideration all the time required to move the boilers to the machine, or lost in setting up the work. In girder work the difference is greater in favor of power rivet driving; as many as 5,000 rivets are said to have been driven by one gang with one portable hydraulic riveting machine in ten hours, including all the lost time of setting up the work and removing it when done.

Many experiments have been tried to determine the efficiency of direct acting power-riveting machines in comparison with hand driving. The hand rivet fills up the hole very well immediately under the head formed by the hammer, but sufficient pressure could not be given to the metal, or rather it could not be transferred far enough to affect the metal some distance from the head.

So great is this difficulty that in hand riveting much shorter rivets must be used, because it is impossible to work effectively so large a mass of metal with hammers as with a machine. The heads of the machine rivets are therefore larger and stronger, and will hold the plates together more firmly than the smaller hand riveted head.

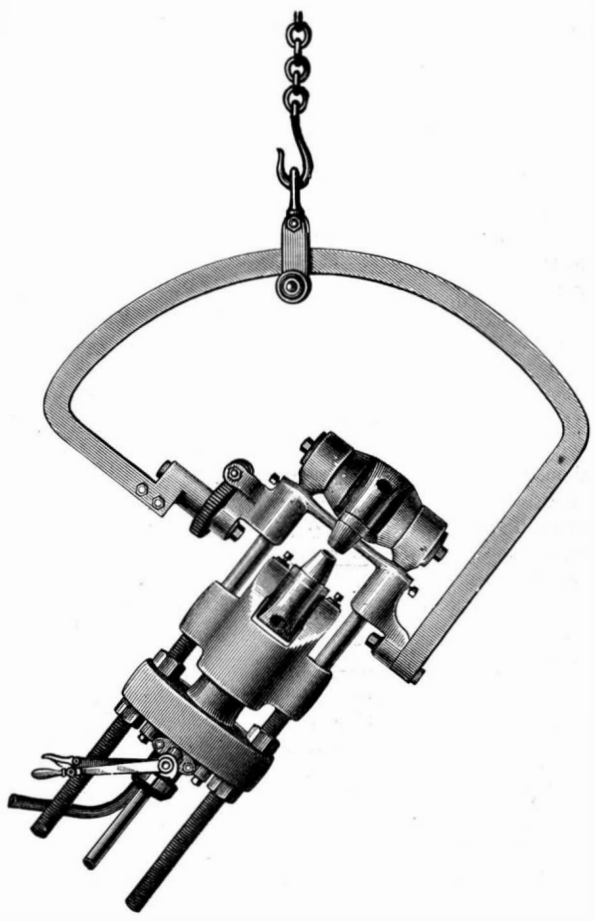

Fig. 3.—SUSPENDED RIVETING MACHINE—BOTTOM VIEW.

The cuts we have presented of Mr. Tweddell's riveting plant are illustrative of the machines as made in this country by Messrs. Wm. Sellers & Co., of Philadelphia. This firm controls the invention in the United States, and has added many improvements to the original machines.

The Scientific American Catalogue.

We have ready for delivery a catalogue of many of the important papers published in our SUPPLEMENT for some time past. These papers are by eminent writers in all the various departments of science. News agents and others who desire copies of this catalogue can obtain the same free by addressing the publishers, Munn & Co., 37 Park Row, New York.

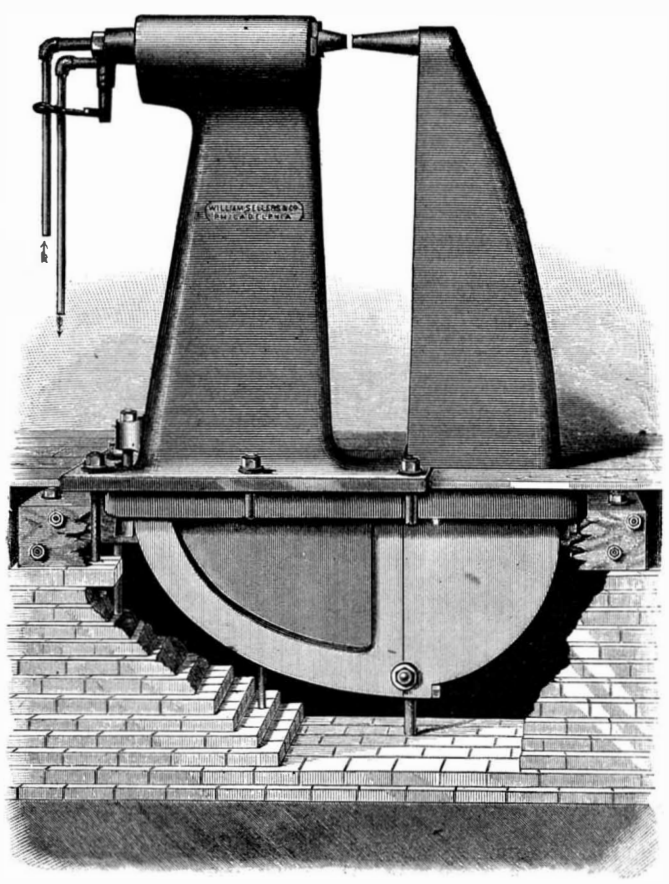

Fig. 4.—STATIONARY RIVETING MACHINE.

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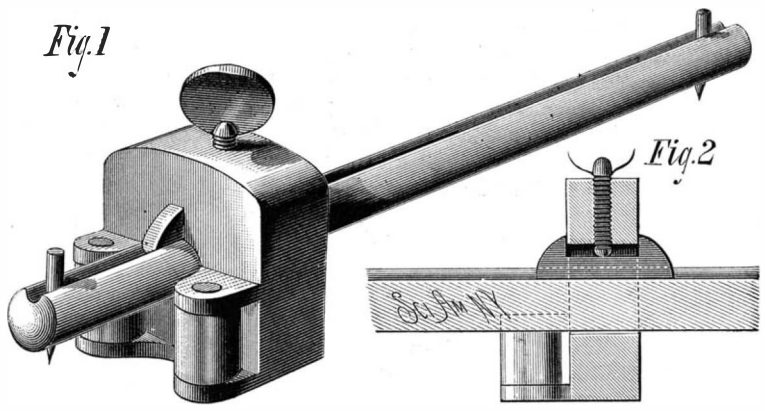
IMPROVED CARPENTER'S GAUGE.

We give herewith an engraving of an improved carpenter's gauge designed for both measuring and marking. It is especially useful in following curved surfaces. Figure 1 is a perspective view, and Figure 2 is a longitudinal section taken through the center of the gauge shaft. The improvement consists in providing the gauge with two bearing-rollers, one on each side of the shaft. These rollers are arranged in relation to the other parts, so that they furnish two bearing points equidistant from the gauge shaft and parallel with the face of the gauge head.

This form of gauge insures the same accuracy in gauging or measuring from curved edges as from straight edges.

Further information may be obtained by addressing the inventor, Mr. Alban Heiran, San Leandro, Alemeda Co., Cal.



HEIRAN'S CARPENTER'S GAUGE.

Trichinosis.

The *Veterinarian* for February has a very comfortless article on trichinosis. It draws attention to the extremely small amount of knowledge we have of the extent of prevalence of trichinæ in home-fed pork, to the certainty of this form of parasite infesting largely American pork, and to the difficulty of discriminating trichinosis in man from enteric fever and acute rheumatism. From these considerations it argues that trichinosis is probably of more common occurrence among human beings in this country than has hitherto been conceived, and suggests the necessity of some steps being taken by the Government or the Legislature to insure some greater degree of safety in this matter than now exists. Our contemporary confesses that it is much easier to advise than to act, but inertness under such circumstances is unjustifiable.

NEW FLUID PROPELLER OR MOTOR.

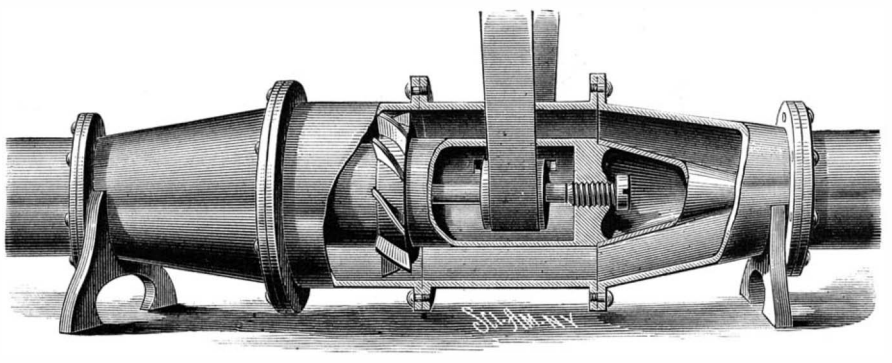
The annexed engraving represents a device for propelling fluids through tubes, and also for utilizing the motive force of fluids flowing through tubes.

A wheel having diagonal blades is mounted upon a shaft journaled axially in a cylindrical casing. This shaft is supported by a hollow cylinder which covers the sides of the wheel, leaving only the blades exposed.

The inner cylinder has conical ends, and is connected with the outer cylinder by hollow arms through which passes a belt, which drives the wheel when the device is used as a fluid propeller. When the machine is used as a motor the belt receives its power from the pulley on the wheel shaft. The inventor proposes in addition to the uses already named to use the device as a fluid meter.

In actual use the main casing will be connected with the pipes through which the fluid is to be moved or through which water flows if it is to be used as a motor.

This improvement is the invention of Mr. John B. Vliet, of Dartford, Wis.



FLUID PROPELLER OR MOTOR.

NEW LAWN EDGE MOWER.

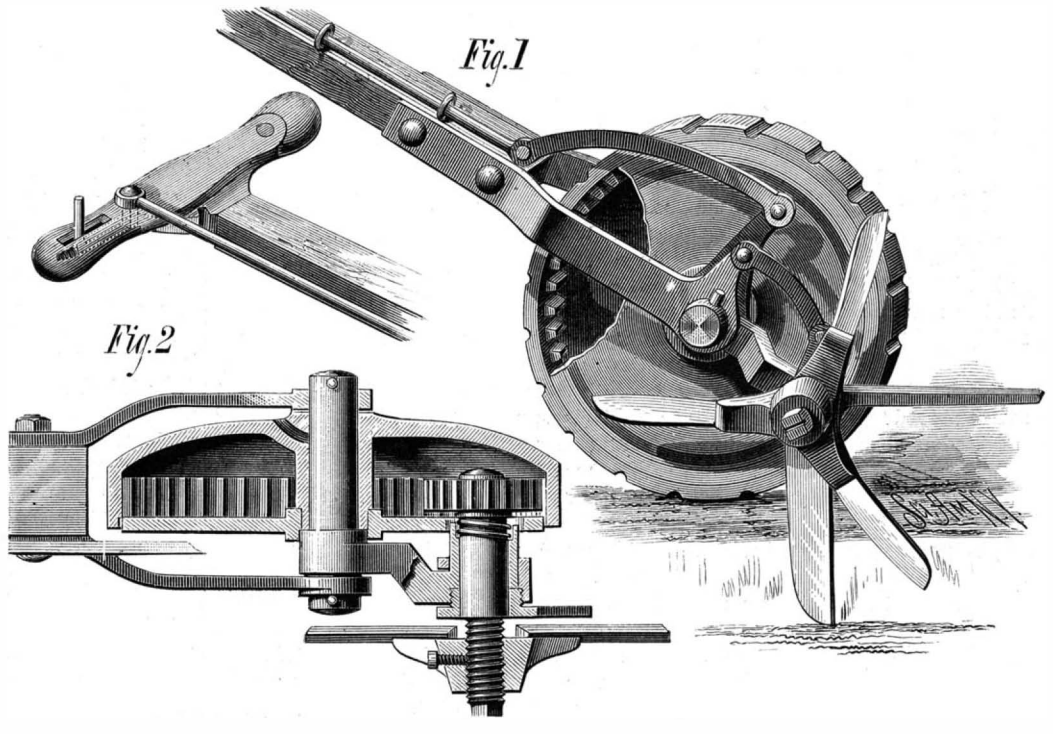
The annexed engraving represents a simple and effective machine for mowing the edges of lawns, borders, etc., a work that is generally done by hand tools with considerable labor if indeed it is done at all.

By reference to the engraving it will be seen that a three-bladed cutter, driven by a single drive wheel, is arranged to revolve in front of a nearly vertical stationary cutter. Both the stationary and rotary cutters are supported by an arm extending forward from the main axle of the machine. The height of the cutting mechanism is adjusted by moving the main axle in one direction or the other by means of a lever at the end of the mower handle, acting through the connecting rods extending down the handle, and jointed to and extending upward from the main axle. The stationary cutter and a horizontal finger or guard are secured to a sleeve on the shaft which carries the three bladed cutter, and they are kept at the proper angle by a link connecting an arm on the knife-supporting sleeve with an arm on the lower end of the handle.

Fig. 1 shows the mower in perspective; Fig. 2 is a section taken through the axes of the drive wheel and the rotary cutter; and Fig. 3 shows the lever at the upper end of the mower handle.

This mower is provided with ratchets to admit of drawing it backward without revolving the knives, and it has all necessary adjustments to compensate for wear.

Further information concerning this useful invention may be obtained from the inventor and patentee, Mr. Timothy Hanley, 1679 Tremont street, Boston Highlands, Mass.



HANLEY'S LAWN EDGE MOWER.

Engines for Farmers.

A writer in the *Prairie Farmer*, who seems to be familiar with the various engines in use for agricultural purposes, thinks that great improvements may be made to render farm engines more available. Of the locomotive self-propelling kind he ranks the Aveling & Porter machines as unequaled in point of efficiency, durability, and economy. The only objectionable feature of these engines, and not only these, but of all that have yet been produced, is the great weight. Inventors and manufacturers will do well to remember that an agricultural and farm locomotive, to prove satisfactory, must have the following qualifications:

1. It must be sold at a moderate price.
2. It must be well made, strong, and durable.
3. It must be so designed that one man can operate it.
4. It must carry its own fuel and water, in quantities sufficient for several hours' work.
5. The weight should not exceed 9,000 pounds.
6. It must have wide wheel-bearing surface.
7. At least 75 per cent of the entire weight should be thrown on the drive wheels so that they will not slip.
8. It must be easily and quickly started, stopped, reversed, or turned around.
9. With an ordinary load, it should travel at a speed of from four to six miles per hour.

An engine having all the above qualifications would prove to be well adapted to the needs of the farmer, and there is probably no better field than this for the inventor and manufacturer to exert their ingenuity.

The Weather and Health in Europe.

It would seem that Ireland is not the only place abroad whose people are in a distressed condition. Intense cold has prevailed over all Europe this winter, beginning early and lasting with continued severity. The effect on the public health has been trying. The mortality reports of all the large cities, according to the *Medical Record*, show an increase in the annual death rate quite striking at times. Rome has reached 38 and 40 per thousand per year. In Naples a malignant fever has been prevalent. At the health resorts on and near the Riviera cold rains, light snows, and damp days have prevailed. At Berne, one hospital received in the week before Christmas 50 patients suffering from severe frost bite. In Paris the applications for entrance to the hospitals in December were 1,000 a week in excess of the accommodations. Silesia has been frightfully ravaged by hunger and typhus, as has also Ireland at one extremity of the continent and Turkey at the other.

Very recently a Rome dispatch to the London *Standard* says: The accounts from Terra di Lavori, Naples, continue to be terrible. The population of seventeen communes especially afflicted numbers 92,382 persons. Of this number, 51,340 had been attacked by fever up to the 15th of December last. This fever means famine. The government aid is not sufficient.

Scientific Farming Practical.

Mr. Buckmaster, before a well attended meeting of farmers, held at Tadley, in England, the other day, to consider a scheme for teaching the science of farming, said that there was no opinion more deeply ingrained in the mind of the English farmer than the belief that there was some antagonism between science and practice. Some even went so far as to say that the two are incompatible. The farmer who drains his land or tries a new manure, or a new machine, or a new crop, calls himself a practical man; he despises all experiment, and laughs at the teaching of scientific men. He is not conscious that when he is thinking over new plans and adopting new methods of cultivation he may be illustrating in his daily work a series of chemical and physiological experiments of extreme complexity and importance. Men of the highest order of intellect, and whose researches were the most original, have been practical men. Practice and theory are but phases of the same form of thought. The practical farmer, if he ever permits his mind to rise above the traditions and empirical rules of his forefathers, and asks, "Could not that have been done in a better and more perfect way; would not this be an improvement?" becomes a theorist, and when he tries to realize these conceptions becomes a practical man. Theory and practice are inseparable in every art, however much men may seek to disunite them. The most practical man is often the most theoretical. Every operation is with him a theory. He recognizes no change; he will admit of no trial or experiment, because that would be an acknowledgment of science. Every science is built up of principles, and these principles carried into work are called practice. There is the science of astronomy and the art of navigation; the science of geometry and the art of land measuring; the science of mechanics and the art of making machinery; the science of chemistry and the art of agriculture. Almost every science is the basis of a cognate art. The most obvious and natural way of arriving at a real knowledge of the art of agriculture would be to know something of those principles on which the art is based, art being nothing more than the application of principles previously acquired. A farmer who is able to unite a perfect mastery of principles with a knowledge of practical details is an educated and scientific farmer. It might reasonably be inferred that the shortest and easiest method of learning any industrial art, and the surest guide to new discoveries in the art, would be a knowledge of those fundamental principles upon which the art was based. No amount of practical skill and experience could ever replace the want of scientific knowledge in farming.

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Correspondence.

Vaccination and Science.

To the Editor of the Scientific American:

Your issue of November 15, 1879, lies before me, containing a strange article entitled "Anti-Vaccination Folly." I am somewhat amused to find how many concessions you make to those whom you charge with "folly." For instance, you say "the adverse statistics derived from European experience, or from American experience, previous to the adoption by our physicians of correct methods and uncontaminated virus, may be all strictly true, and doubtless are substantially true; yet our confidence in proper vaccination need not be shaken in the least."

Permit me to point out that those who have so much "experience," and so much "statistics" in their favor, cannot be, by any scientific rules, "fools." The scientific method proceeds by experience, and the collected results of experience (statistics). It appeals to facts, and to facts above suspicion—"true" facts. It deduces nothing from conjecture, where conjecture is not only out of place, but contradicted by facts. And yet you concede our European facts, permit us certain admissions from American facts, and then denounce us as having sent you a gentleman "with a craze," to "propagate our notions"—our "anti-vaccination nonsense"—in America.

Hard words are harmless, except as they lead to violent behavior. And your position as promoters of science may give to your hard words force which may spend itself in violent behavior toward worthy American citizens. It is, therefore, my duty and my pleasure to show that our cause is the cause of science and of freedom.

Now, to begin with, what is your charge against us? It is, that however true our arguments may be in England, or Europe even, they "can have no application here," *i. e.*, in America. And we are urged to "study the methods employed in this country, and try them at home."

Now, will it be believed that this is actually the whole case urged against us? Bovine virus, or not "over-humanized" virus, will stamp out—I understand you to say has stamped out—smallpox in New York. Therefore it will anywhere. But I have made myself as familiar as Dr. Martin's very courteous behavior toward me has enabled me to become, with your American system.

That system, let me tell your readers, is nothing new. It has been in operation in Europe from Dr. Jenner's day to this. And it has here yielded no such results as you describe it to have accomplished in America. Smallpox, let us all be cool-headed enough to remember, is an epidemic disorder. For long years it is absent, and then comes like a flood. It was declared in 1870 that the excellent vaccination in Ireland had banished the smallpox. In 1873 they knew at fearful cost the error of any such a calculation. I am not aware of any existing real positive evidence showing proof that bovine virus is better as a protection than "arm to arm." Dr. Warlomont has had great experience of the very same system as the one you advocate. He has a few days since appeared in London to give *éclat* to an endeavor to procure state patronage for "calf lymph." What does he say? Our system, he said, was "to be scrupulously observed. . . . This proposition is based upon a fact, without which it could not be maintained—the perfect identity between the lymph of the child and of the calf, so far as regards their active principle." He cites experiments made to prove this, and continues: "The identity is, therefore, perfect as to the nature of the active principle of the lymph, whether it is derived from the calf or the child." . . . "This identity is established, if possible, still more completely by my own personal experience."

"But it will be asked," he says, "if the two lymphs are of equal value, why call to the aid of humanized lymph, the supply of which never fails, the assistance of animal lymph? The answer is that this help is especially necessary to satisfy doubts, fears, imputations, and perhaps prejudices."

I hope these quotations make it clear that arm to arm lymph is equal in power and energy to calf, in the opinion and by the experiments of one of the most ardent defenders of bovine virus. Things which are equal cannot differ in quality.

But why, if it is so much more powerful, do the calf specialists, when pressed, deny its superior powers against smallpox? Why is there no array of European experience to prove its virtues, for it has been propagated here long, long years before it was thought of by Dr. Martin? The answer is that given by Dr. Warlomont: It is not used because it is more prophylactic, but to satisfy doubts, fears, and prejudices.

Now, may I assume my contention as to the absence of proof of the superior virtue of bovine virus proved? Evidence showing it does not exist, its own defenders abandon the contention when pressed.

But by the very crucial evidence to which you refer, we know scientifically the want of value in the arm-to-arm or "classic" method. Here is the last nine years of smallpox hospital experience I am able to get access to: Liverpool Hospital, 1875–6; Glasgow, 1870–2; Homerton, 1871–6; Metropolitan, 1870–1–2; Dublin, 1870–3, 1876 and '8; London 1876 to 1879 to Oct. 1—these yield 37,636 cases of smallpox. And the medical gentlemen attending these cases record no fewer than 28,468 of them as vaccinated. There is here an unparalleled failure, a signal disproof of Jenner's rite. Hold! you say, how many died?

Now the answer to that question set the *Lancet* thinking a very long time since; and I am not aware that up to this time it has thought out a satisfactory explanation. Our answer is that the number recovered out of every hundred of these hospital cases is roundly just what it was before Edward Jenner was born, namely, 82.

Jurin, 1723, gives nearly 83; Duvillard, 1700 to 1763, gave nearly 82; Rees, 1779, just 82.

And, further, the character of the disorder remains exactly the same that it was and has been so far back as exact accounts show it. The fatality now as ever is just as is the eruption. If that is extensive, then the deaths are numerous; if malignant, nearly all die; if the pustules are few and far between, the mortality is very slight indeed. This is the scientific classification of the disease. It is unaffected by vaccination, and applies to unvaccinated and to vaccinated alike. So it was before Jenner's day, so it is now.

But a disorder which treats its victims just as it treated them before the "annihilator" of it appeared, which follows the same erratic ways of appearing, which cannot be controlled in this epidemic tendency by its "annihilator," is, let us be plain and straightforward enough to confess, an untouched disorder. The so-called preventive is therefore a delusion. The money spent upon it is therefore wasted; liberty invaded and the person violated in its favor are therefore wantonly and unjustifiably treated to the national ill-being. Superstition usurps the place of reason, and violence the place of right.

It must follow from these considerations, which every fresh experience does but confirm, that the day will come when the men of science will denounce this rite. Then the gentlemen who, in the cause of science and humanity, visited you some time since to show the nature of this delusion, and endeavor to clear America from so great a stain upon free institutions, will receive his due. Galileo, condemned by the men of his time for having a craze; Bruno, burned by the great men of his day for being a pernicious fool—are the honored of Italy to-day. So will all those be who, against much prejudice and opposition, strive to lead the people to the light, supported by science, and encouraged by the fact that truth is on their side.

I am yours truly,

Darlington, Eng. ALEX. WHEELER.

Solar Spots.

To the Editor of the Scientific American:

During the past few days excellent and interesting obser vations of sun spots have been made. This phenomenon of our central orb has been quite infrequent for two or three years, having been passing through the minimum stage of the spot periodicity. The cycle or period is about eleven years, and for the coming five or six years large numbers may confidently be expected, and of very extended dimensions.

On the morning of the 3d inst., two separate groups of spots were noticed, situated one above the other, and having made about one-third of their transit of the sun's disk, as represented in Fig. 1. All the figures are shown as seen in the telescope, or inverted.

The group marked A was a fine double one, preceded by an intensely black, small, round spot, as shown in the sketch

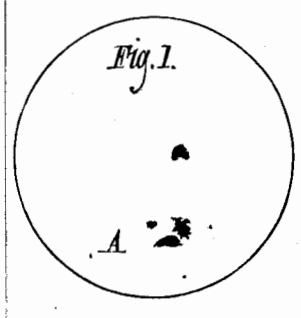

Fig. 1.

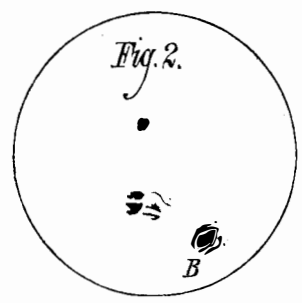

Fig. 2.

near A. On the morning of the 6th, this small round spot had disappeared, but others had developed upon the other side of the double one; and just fairly entered upon the eastern limb was a fine large spot (B, Fig. 2), which promised to develop into an interesting group. The appearance of the sun on this occasion is shown in Fig. 2.

On the morning of the 8th the sun's face presented the appearance shown in Fig. 3. The spot, B, confirmed the impression given on the 6th, and by its improved position, as well as some internal change, gave us the appearance here shown in Fig. 3. My attention was also attracted to some new very minute spots near the center of the sun, marked C, Fig. 3. This was the appearance on the morning of the 8th. In the afternoon of the same day, or only five hours later, these minute spots had changed into the appearance shown in Fig. 4, drawn to the same scale—a wonderful change having thus taken place in these few hours. What an enormous energy is here manifested!

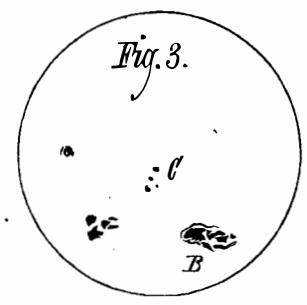

Fig. 3.

Fig. 4.

The group, B, continues to be one of the greatest interest. It is large, and broken up into a number of parts, surrounded with a delicate penumbra and straggling lines. Fig. 5 shows a highly magnified view

Fig. 5.

of this group as seen this morning, February 9, 1880.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., Feb. 9, 1880.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR MARCH, 1880.

Mercury.

On March 1 Mercury rises at 7h. 10m. A.M., and sets at 6h. 56m. P.M. It may be found 2° east of Jupiter.

On March 31 Mercury rises at 5h. 25m. A.M., and sets at 5h. 29m. P.M.

Mercury is at its greatest elongation from the sun on March 10. It should be looked for after sunset, in the first half of the month, a few degrees north of the point of sunset. In the latter part of the month it sets too nearly with the sun to be seen.

Venus.

Venus is still seen in the morning, although nearer the sun and less brilliant.

On March 1 Venus rises at 5h. 9m. A.M., and sets at 2h. 50m. P.M.

On March 31 Venus rises at 4h. 52m. A.M., and sets at 3h. 59m. P.M.

Venus is near the waning moon in the morning on March 8.

Mars.

On March 1 Mars rises at 10h. 12m. A.M., and sets at 1h. 14m. of the next morning.

It can be seen north of Aldebaran on the 3d.

On March 31 Mars rises at 9h. 16m. A.M., and sets 33m. after midnight.

The "American Nautical Almanac" gives the time of an occultation of Mars by the moon, on March 17, as 6h. 22m. P.M., Washington time.

The moon will be at this time nearly at the first quarter, and Mars will be about an hour past the meridian, at a good altitude above the horizon.

The dark part of the moon passes first between us and the planet, and the planet disappears. Mars will be hidden for more than an hour, and will then reappear on the west of the moon; the strong red light of Mars and the pale yellow-white light of the moon will be shown in beautiful contrast. If the evening should be fine this will be very interesting, even as seen with the naked eye.

Jupiter.

On March 1 Jupiter rises at 7h. 8m. A.M., and sets at 6h. 39m. P.M. It may possibly be seen after sunset.

On March 31 Jupiter rises at 5h. 26m. A.M., before sunrise, and sets at 5h. 18m. P.M., before sunset. It may possibly be seen before sunrise.

Saturn.

On March 1 Saturn rises at 8h. 3m. A.M., and sets at 8h. 28m. P.M.

On March 31 Saturn rises at 6h. 14m. A.M., and sets at 6h. 49m. P.M.

In the early part of the month Saturn may be seen a little north of west when it sets; in the latter part of the month its diurnal path is nearly that of the sun, and it will not be seen.

Uranus.

Uranus is in good position for observers, almost at its best position, early in March, as it then comes to meridian a little before midnight, at an elevation of nearly 60° in his latitude.

On March 31 Uranus comes to meridian near 10 P.M.

On March 8 Uranus has the altitude of the star Rho Leonis; is east of it 2°, and moving toward the star.

Sun Spots.

The spots which were seen upon the sun in January returned in February, and were followed in their course from February 2 to February 6, photographs being carefully taken and drawings made. Up to February 6 three groups were seen, each of them including several spots.

After February 6 clouds interposed until February 8, when it was found that a fourth group had appeared upon the sun's disk; it had apparently formed among the others, but was not near enough to them to be a detachment from any one of them. Seen with a small telescope, some twenty individual spots could be counted in the four groups.

If these return again they should be seen late in February, and should by March 1 be easily found with a small glass; possibly with a smoked glass without magnifying yower.

The Ali Baba Vase.

It is said that Miss M. Louise McLoughlin, of Cincinnati, to whom the ceramic art in America owes so much, has completed the largest vase ever moulded in this country. It is called the Ali Baba Vase, and stands 37 inches high, with a diameter of 17 inches. Before firing it measured 44 inches in height and 19 inches in diameter.

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AMERICAN INDUSTRIES, No. 33.

MANUFACTURE OF ROLLED IRON.

The great revival of trade in the United States within the last few months has been marked by an unprecedented activity in iron and steel manufactures. This great activity is remarkable for the suddenness of its development as well as its universality.

There are at present more furnaces in blast in this country than ever before, and the rolling mills, although working up to their full capacity, are inadequate to supply the immense demand for manufactured iron. Now, as there is scarcely a mechanical occupation that does not depend for its tools, machinery, or raw material upon iron and steel, it follows that the condition of the iron industry is in some measure at least indicative of the state of other interests. It is not, therefore, to be regretted that the demand for iron is far in advance of the means of supply, as this state of things may be regarded as one of the best indicators of present and future prosperity.

For our principal illustration we have chosen from the many works devoted to the industry under consideration the Union Iron Mills, of Pittsburg, Pa., owned and operated by Messrs. Carnegie Brothers & Company.

These mills were established in 1860. They are devoted to the manufacture of structural iron for bridge building and architectural purposes, iron beams, channels, tees, angles, etc. Iron in these forms enters more and more into the composition of various structures, and this already extensive branch of manufacture must of necessity increase with the growth and development of the country.

The Union Iron Mills give employment to about 750 men, and are capable of turning out annually 40,000 tons of manufactured iron. The works cover eight acres of ground, with buildings as follows: Main building, 400 feet long and 80 feet wide, having attached to it five wings, each 137 feet long and 50 feet wide. The fitting shop is 100 feet long and 40 feet wide. The roll house is 150 feet long and 20 feet wide. The building covering the heating furnaces is 400 feet long and 37 feet wide. Two buildings in the puddling department are each 200 feet long by 65 feet in width. Two gas producer houses, one 100 by 50 feet, and the other 46 by 35 feet, cover twenty-four producers.

These extensive buildings contain the most approved modern appliances and machinery. The works are provided with thirty-one puddling furnaces, seven double Siemens heating furnaces, two single Siemens, and two reverberatory furnaces. The machinery is driven by seventeen engines located at different points, and arranged conveniently with reference to the work to be done. These engines are supplied with steam from fifteen boilers, twelve flue boilers, one Kilgore boiler, and two tubular boilers. The pump that supplies water for the purposes of the mill has a 16 inch cylinder and 3 feet stroke, and throws 700 gallons of water per minute.

The smaller view in the upper portion of the engraving, gives a good idea of the external appearance of the works, and some of the machinery is represented in the other views.

The first operation in the manufacture of wrought iron is that of puddling, which is simply a process of removing from pig iron, by the combined action of an oxidizing atmosphere and mechanical agitation, the carbon, silicon, sulphur, and phosphorus.

This operation is carried on in reverberatory furnaces, and attended by men whose business it is to stir the semi-fused pig iron on the hearth of the furnace until it is brought to the proper state of consistence, when it is gathered into balls as large as can be conveniently handled, and taken directly to the squeezer, which compresses the ball and forces out the greater portion of the scoria and cinder.

The squeezer is a powerful machine, consisting of a heavy corrugated cylinder revolving eccentrically in a concave frame. From the squeezer the bloom is taken while still hot to the rolls, through which it is passed several times, reducing it to the form of a bar called a puddled bar.

The puddled bars are piled together, reheated in the heating furnaces, and then passed through rolls, which shape them for market. There are six trains of rolls in the Union Iron Mills—one 20 inch train, two 18 inch trains, one universal plate mill, one 12 inch and one 8 inch train. The huge 20 inch train is represented in the larger view in the engraving.

These immense rolls, with their massive housings, seem the very embodiment of strength, and as they are revolved with a resistless power, it is a grand sight to see the heavy white-hot beams shoot out first from one side of the rolls and then from the other. The method of handling these large masses of hot iron is both simple and efficient. The mass of iron as it comes from the heating furnaces is delivered to the first pair of rolls by ponderous tongs, as it passes through it is caught upon the ends of levers whose fulcra are suspended from movable carriages above. The men holding the long ends of the levers, dexterously thrust the shorter end under the rapidly moving bar, immediately press down upon the longer end so as to give the bar support, and then follow the bar as it moves forward. After it has passed completely through the rolls in one direction, it is raised by the levers and guided between the middle and upper roll, and as it again issues from the rolls it is caught and supported by the men on the other side. The perfect ease with which these beams, weighing thousands of pounds, are handled is astonishing.

Some of the beams are cut into lengths while hot, others are cut while cold. This firm use three saws for cutting iron when cold, and four hot saws. They were the first to use "cold saws" for cutting iron cold. The machinery for sawing the iron is seen at the further end of the train of rolls. It is very like a cross-cut sawing machine for wood, excepting that it is adapted to the heavy work of sawing the iron beams instead of wood. The beam to be sawed is placed upon a strong iron carriage capable of moving back and forth on a track, and is moved against the edge of the saw, which cuts its way through.

The gigantic machine shown in the small circular view is the universal plate mill for rolling the heavy plates used in building war vessels, turrets, etc. It is capable of rolling a plate 36 inches wide 3 inches thick, and almost any length. The plate as it passes from the rolls on one side or the other is supported by a series of large iron rollers. Among other pieces of heavy machinery employed in this establishment are two punches, one machine for slotting, and eleven heavy shears, all of which are massive, powerful, and well calculated to withstand the strain that must naturally come upon them.

In addition to the works above described, this firm own the Lucy Furnace for the manufacture of pig iron, employing 200 men and producing nearly 700 tons weekly. This furnace has two stacks, each 20 feet bosh and 75 feet high. The blast of each furnace is heated in four iron pipe stoves to a temperature of about 950 degrees. The blast is furnished to each furnace by two vertical direct acting engines, each having a steam cylinder 35 inches in diameter, a blast cylinder of 84 inches diameter, stroke 48 inches.

The supplies of ore used at this furnace are mainly from the Lake Superior region. The fuel consists of coke, about two thirds of which comes from the works of the firm at Carmenter's Station on the line of the Pennsylvania Railroad, the remainder coming from the Connelsville district.

An Owl at Sea.

The White Star steamship Celtic, which arrived at New York from Liverpool on Wednesday, Feb. 11, brought a strange passenger who had boarded that vessel in mid-ocean. A large white owl dropped on one of the forward spars in an exhausted condition one evening, when the vessel was about 800 miles off the coast of Newfoundland. When brought to the deck by a sailor, the owl was found to be nearly dead from cold and hunger, and almost too weak to eat.

It had become greatly emaciated, and trembled violently in endeavoring to swallow the first morsel of meat which was placed in its beak. The owl slowly recovered, and is now perfectly well. It is a land bird, and is supposed to have been blown off the coast of Newfoundland by the westerly gales which had for some days previous prevailed there. Finding itself once out at sea, it had probably ceased making efforts to reach the land, and had drifted before the gale, its only efforts being to keep above water. The bird must have possessed remarkable powers of endurance, the officers say, to have kept up so long. The Celtic's owl, which is now quite tame, measures nearly five feet from wing to wing, and is white with the exception of a few small specks of dark color. It will probably live for some time to come on board the vessel which it selected as its home while in mid-ocean. Land birds have rarely been seen so far out at sea.

Etching on Glass.

An article from the pen of William Gruene, of Berlin, on the process of etching drawings or letters on glass, in relief or opaque, has lately appeared in the Dresden *Glasshutte*, which, says the *American Pottery Reporter*, we have translated and present to our friends, the glassmakers of America. As is well known, indestructible drawings on glass are made by a cold chemical process, by etching with diluted fluoric acid, first covering the places not to be eaten away with an acid-resisting material. The fluoric acid dissolves the glass without affecting the appearance of the parts protected. In consequence the drawing or design appears slightly opaque. The desired effect is then obtained by mechanical means. The elevated parts are ground rough, so that the alternate rough and smooth portions form the picture. The drawings must be etched deep, in order to avoid the deep lines in the mechanical work. It is necessary that all parts which are to become opaque must be covered with the coating, in order to avoid their destruction by the fluoric acid.

The new process described by Herr Gruene avoids all the difficulties surrounding the present process of etching, and enables the workman to stamp, mark, and ornament glass as if it were paper. The principle applied is as follows: The quality of the fluoric acid used is the same as in the old process, but the drawing is no longer made with a substance absolutely proof against the acid, but with another, protecting the glass only to a certain point of time, thus showing in the drawing the elevated marked opaque appearance. For such a covering almost all the lacs, oil varnishes, greasy printing dyes, etc., except the solutions of asphaltum, gutta percha, and caoutchouc, can be used. If applied thin, they yield to the concentrated fluoric acid, even after a few seconds, no matter how firmly dried they may have become. If the substances for covering are used simply for the above named purposes, they yield only a very feebly marked design, partly marked and partly blank; but if dusted after application with a finely pulverized powder of metal, copal, or any other substance capable of rendering longer resistance to the fluoric acid, the opaque drawing is obtained directly. This is the essential point of the invention.

For practical use the following advantages become apparent: 1. As the etching is rapid and not deep, no special protection of the surface by coating with acid-resisting material is necessary. 2. As only slightly resisting covering substances are necessary, the workman can use not only brushes, gravers, pens, and patterns for drawing purposes, but can also easily make transfers from all typographical, lithographical, copper, zinc, glass, and other prints. In like manner elastic stamps and forms can readily be used. As one can use, *ad libitum*, thicker or thinner coats, as well as apply coarser or finer powders for dusting, the opaque parts can be produced in any grain desired. In one and the same etching graded designs with proportional shades can also be produced.

The practical execution of this style of etching is carried out as follows: The article to be decorated receives the drawing by hand, stamp, or, as the case may be, by transfer. For the material choose an oily lac mixed with a little paint, so as to show on the glass. This done, dust in the powder. When dry, dip the part with the drawing into the fluoric acid, or put the latter on with a brush, and allow to remain a few seconds, or until the powder begins to come off. Then rinse with water. The greasy substance need not be removed, as the fluoric acid absorbs it.

The United States as a Wheat Country.

A little over thirty years ago the *Springfield Republican* notes that grain was imported to this country from the Black Sea. During the crop year on which the country is just entering, it claims that it is certain that 160,000,000 bushels of wheat will be exported to Europe, and the amount may reach 200,000,000 bushels. The grain is in this country; the only question is one of demand. The demand last year from Europe was for 159,000,000 bushels out of a crop estimated at 420,000,000 bushels. The production this year is larger. It is one-fourth larger in Kansas; in Minnesota the production this year is 40,000,000 bushels, a large advance over last year; the grain fields of Southern Ohio show an unprecedented yield; so do those of Iowa; and in Indiana the crop will, in some cases, pay for the ground on which it stands. The wheat acreage of the country is put at 31,000,000 acres, an increase of one-fifth in two years. The average yield is placed at 12 bushels an acre, and the acreage at 31,000,000 acres, by Alexander Delmar, who wrote to the *Times* in the close of July, after a trip through the wheat fields of the West, ending at Ogden. The statistician of the New York Produce Exchange puts the average yield at from 11 to 12 bushels; other more sanguine estimates carry it up to 13 or 14 bushels an acre. The lowest estimate yet made places the crop at 360,000,000, the largest at 440,000,000, and a crop of 420,000,000 may be reasonably counted upon. This is an increase in ten years of 133,000,000 bushels in the annual wheat production of this country, and an increase nearly equal to the total wheat harvest of twenty years ago.

Out of this year's harvest, reckoning the population in this country at 48,500,000 persons, 194,000,000 bushels will be needed for consumption and 50,000,000 for seed, in all 244,000,000; leaving, at the highest estimate, 196,000,000 for export, to which may be added 20,000,000 bushels left over from last year's crop. Whether the European demand will be equal the amount of surplus wheat in this country is considered by the *Republican* as doubtful. It will unquestionably equal last year's demand, and the value of the breadstuffs exported during the coming year will probably reach $150,000,000, and may rise to a higher figure. The unknown quantity in the wheat supply of the world is Russia. Its harvest has been pronounced far under the average for weeks past, but recent advices tell a different story. At best, however, nothing more than an average surplus for export is to be expected, not over 50,000,000 bushels; and if this is supplemented by the usual European import, 20,000,000 bushels from Roumania, and 5,000,000 from Canada and Australia, the total wheat supply which Europe is likely to receive from points outside of this country may be placed at 75,000,000. The current deficiency in Europe is placed at from 225,000,000 to 275,000,000 bushels.

The demand in England is clearly known. It will amount to about 110,000,000 bushels. The demand in France can be less accurately estimated. All Northern Africa is in a state of famine, or is producing barely enough for its own supply, leaving nothing for export. This cuts off one French source of supply in Algeria. The crops in Northern Italy have failed, and Italy is importing grain already, instead of exporting it, which closes another region from which France obtains grain. The potato crop in Northern France has generally failed, and the local food supply all over the republic is deficient. It is a low estimate, then, which places the French demand for wheat at 100,000,000 bushels. The rest of Europe will probably need 75,000,000 more, but may need less.

The food supply of a continent is not a thing to be easily reduced to figures. Moderate estimates, however, place the demand at a larger figure than the amount of the probable surplus in this country. It will probably all be needed, but our authority is not likely that it will be called for at high prices. This is the present outlook. Very trifling causes may change the existing condition of affairs in favor of high prices. One thing is certain: no crop of wheat ever harvested in this country will be carried to market more cheaply, and none, therefore, will leave a larger margin of profit in the hands of the farmers.

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IMPROVED STEAM PACKING.

The sectional packing shown in the annexed engraving is designed for the stuffing boxes of steam cylinders, pumps, air chambers, etc. The metallic packing rings, *g*, have their adjoining faces inclined in opposite directions, so that the pressure of the gland will contract and expand alternate rings, and thus pack the stuffing box and the piston rod. These packing rings are used in connection with a conical sleeve, A, contained by the box and surrounding the piston rod. This sleeve is divided longitudinally into two equal parts, *a*, and into two small wedge-shaped pieces which lie between the ends of the larger portions. The ring is separated into sections in this manner to facilitate the removal of the ring from the stuffing box. Two semicircular pieces, *d*, are placed at the bottom of the stuffing box to adapt the ring, A, to the box. Grooves, *e*, are made in the ring, A *d*, to receive some of the water of condensation, which prevents overheating the packing.

Part of the rings, *g*, are beveled to adapt them to the inner surface of the ring, A. It will be noticed that when the gland is tightened up, the rings, *g*, when pressed, move alternately in opposite directions; that is, the first ring presses the piston rod, the second one presses the inner surface of the stuffing box, and so on.

The inventor claims that the packing remains tight, wears smoothly and evenly, and does away with a great deal of friction which is unavoidable in other methods of packing, and he furnishes a list of prominent mining companies and mill owners in the mining regions of the Southwest, who indorse it and are using it with entire satisfaction.

Further particulars may be obtained from the inventor, Mr. George C. Phillips, of Silver City, Nevada.

PROA LADRONIA.

This boat was built on Cayuga Lake, N. Y., 1877, for T. M. Prentiss, Boston, Mass. (Named for the Ladrone Islands, where the "Flying Proa" originated.)

CONSTRUCTION.—HULLS.

Two half sections of a boat—closed.

Inner Sides.—Smooth and straight from end to end.

Upper Sides.—Flat and at right angles with inner sides.

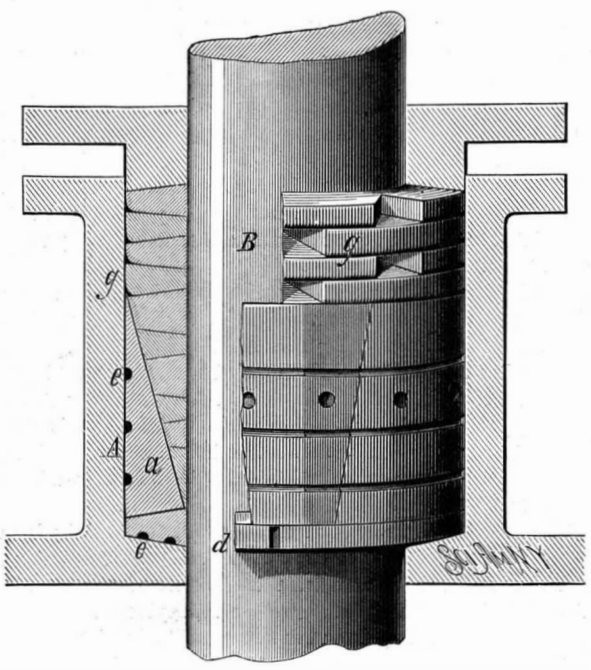
Outer Sides.—Modeled with as much attention given to lines as for a single boat, gaining thereby greater bulk and buoyancy than is possible in straight-sided round tubes or simply boat-shaped pontoons; immense reserve of floating power being essential in a double boat to prevent the leeward hull from being submerged in rough weather.

Ribs of hulls are of oak, covered with ¾ inch pine. Length of hulls over all, 17 feet; width, upper sides, amidships, 18 inches; depth, inner or flat sides, amidships, 20 inches; depth at bow, 29 inches; depth at stern, 24 inches. The hulls are placed 5 feet apart, and connected together by six transverse beams, each 3 inches square, firmly bolted and riveted, alike to the inner and outer sides of hulls.

Each hull is provided with a 2½ inch brassdeck-screw for the purpose of pumping out. As yet there has been no occasion to use a pump.

DECK.

The deck or platform—laid in alternate strips of butternut and pine, ¾ inch thick and matched—is semicircular in shape at the bow and stern. Extreme length of deck, 15 feet; extreme width of deck, 8½ feet. The under surface of deck is sheathed and painted, to prevent any resistance of



PHILLIPS' STEAM PACKING.

the cross beams to the passage of water between the two hulls.

Railing of oak—2 feet high—round the deck, having a base board 4 inches wide, and top board 2 inches wide. Intervening space—18 inches—of rope netting, painted red and white.

BULWARKS.

Painted oilcloth, wound round two spring window shade rollers placed perpendicularly inside a close fitting black walnut case, serves for bulwarks to protect against spray when beating to windward in rough weather.

The Mast.—21 feet; is stepped 5 feet from bows, midway between the hulls. It is square at the foot, where it is made to slip easily into and out of a black walnut box, 18 inches deep. The latter is mortised to one of the deck beams (second one from the bows), and supported by four iron braces riveted to three of the beams, placed nearer together for that purpose when laid than the three aft beams.

RIGGING.

Length of boom, 21 feet; length of yard, 24 feet. Four blocks only are used, three of them single and one double.

The Sail.—Pattern, modified lateen; dimensions, 28½ square yards. Is hoisted by a single halyard, by which alone it is held to the mast above; and below by a stout wooden hoop attached to the boom where it crosses the mast—say 5 feet from the deck—thereby insuring ample head-room, and allowing the sail to veer with the wind as freely as a weathercock, which is particularly advantageous in heavy flaws, as it obviates the necessity of luffing to avoid unusual strain upon mast or rigging.

PERFORMANCE.

Capsizing seems to be an impossibility with this craft. So great is her stability that the mast and entire rigging have been blown overboard without so much as stirring a campchair on deck.

Gibing may be simply denominated one of her most innocent performances.

Being wonderfully steady under canvas, by reason of her double construction, she is wholly independent of ballast.

The flat side of the windward boat always acts as a centerboard; and both hulls being closed against the ingress of water, she never requires bailing. Any water she may ship discharges itself at once without doing any harm. Her weight is about 1,500 pounds, and she draws 6 inches of water.

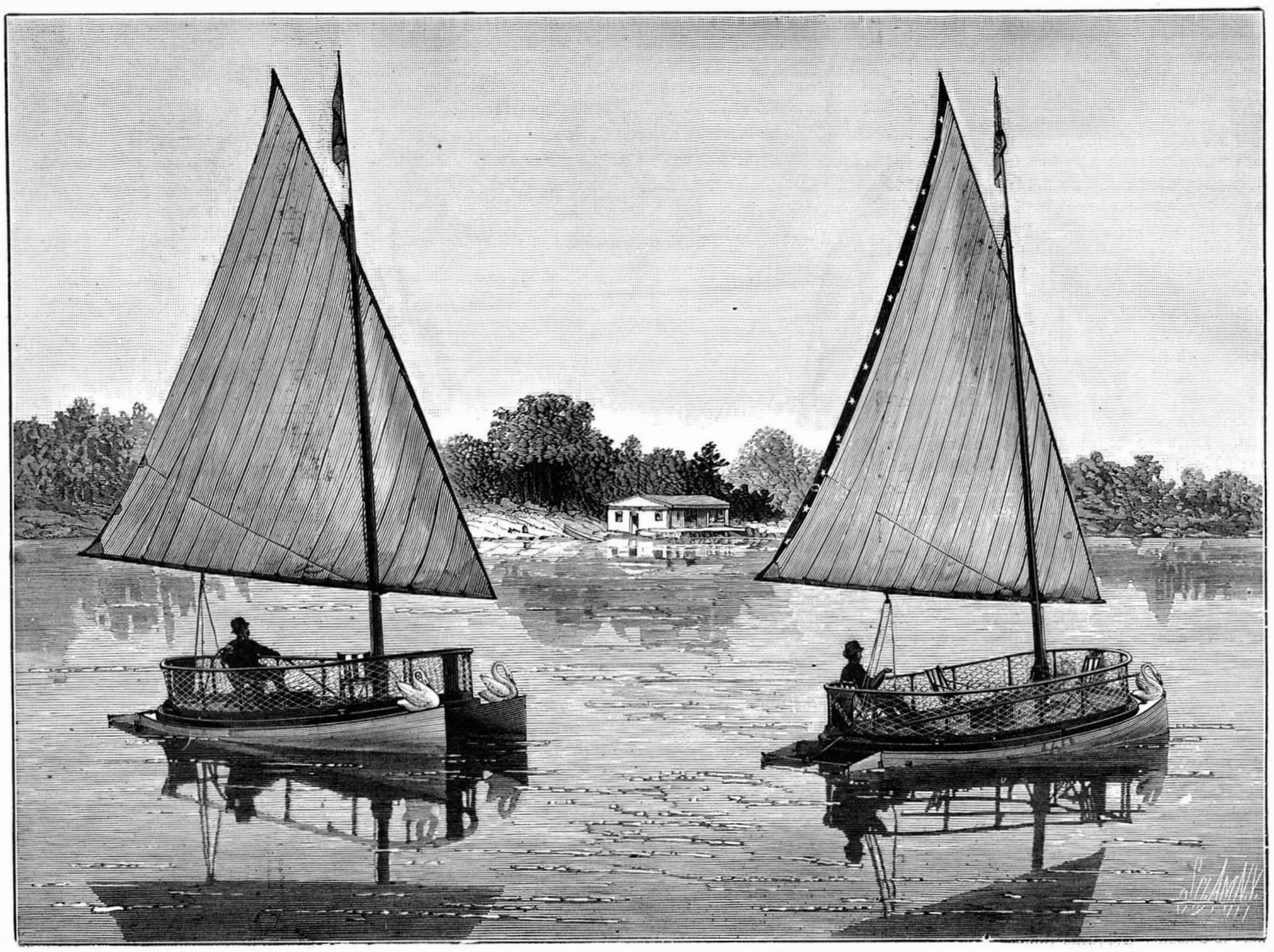
She sails and steers well on all points, and will lay closer to the wind than most ordinary boats, owing probably to the two keels, which give a double hold on the water. On this is largely dependent the ease with which the Ladronia may be put about.

With skillful management of the helm, while close to the wind, she rarely misses stays. A dexterous movement of the tiller at certain points of tacking seldom fails to put her about speedily.

This boat was not built for sea service, but merely to be *safer* and steadier in protected waters than the common open boat. Neither is she suitably rigged for speed, and yet she has repeatedly outsailed the fastest boat hereabouts; one 5 or 6 feet longer than the Proa, carrying double her spread of canvas, and that has always taken the first prize in regattas on this lake.

My object in adopting this style of craft is to render boating here a safe recreation for the ladies of Wells College, who have appreciated, during the past season, the comfort of her roomy deck and freedom from pitching and careening, and my purpose in giving you the result of this experiment is solely that you may call to the attention of your nautical readers a double-hulled boat differing in many particulars from those heretofore introduced into our waters, and whose merits it will always give me pleasure to discuss with *any* of your readers, giving them such further details of construction and performance as may be required.

Aurora, N. Y. T. M. PRENTISS.



PROA LADRONIA—A NEW DOUBLE PLEASURE BOAT.

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Recent Progress in Microscopy.

At the second annual reception of the New York Microscopical Society, February 7, the retiring president, Mr. J. D. Hyatt, gave a brief account of the present condition, prospects, and recent progress of microscopy. After referring to the success of the Continental makers of objectives years ago in attaining a certain mediocrity in the manufacture of lenses, Mr. Hyatt said that of late they have been altogether distanced in optical science by English and American opticians. The principal feature of advance during the past year was the celebrated Zeiss oil-immersion objective.

The formula for the Zeiss lens was worked out by Prof. Abbe, of the University of Jena, whose brilliant discovery, in the hands of the expert optician whose name it bears (Karl Zeiss), has startled the microscopical world with results not hitherto obtained, even with Powell & Laland's famous one-fiftieth. Accor ding to reliable accounts, said Mr. Hyatt, the performances of this lens are marvelous. It is claimed that the *Amphipleura pellucida* is a coarse test of its remarkable resolving powers, and that it copes without difficulty not only with such tests as Nobert's nineteenth band (113 000 striæ to the inch), but also with 125,000 striæ to the inch, mounted in balsam, in the ordinary manner. This result is obtained mainly by the interposition of a film of oil of cedar wood or some other medium of high refracting index, between the front and the thin covering glass, beneath which the object lies. The film thus interposed is made a factor in the formula upon which the lens is constructed, the great loss of light occasioned by media of low refracting power being thus obviated, and the utmost obliquity of the ray turned to practical advantage. The oil also acts as an elastic front, permits ample space for focusing, and thus renders the collar adjustment unnecessary. Again, the front combination is made active, up to 6° beyond the equator of the sphere, a surface exceeding the hemisphere by about one-twentieth of the sphere's diameter being thus applied as a clear lens. This last feature is rather a curiosity than a novelty, Tolles and others having made use of hyperhemispherical lenses in the construction of high-power objectives.

The greatest success in micrometer manufacture of recent years was accredited to Prof. Rogers, of Cambridge, who, by means of a complicated instrument constructed by himself, has been enabled to lay off lines upon a glass slide at distances apart of one one-hundredth and one one-thousandth of an inch with such accuracy that the deviation is less than one one-millionth of an inch.

SCIENTIFIC TOYS.

The toy shown in Fig. 1 was invented by Mr. J. Pfeiffer, and is amusing and at the same time instructive, as it shows all the principal phenomena of statical electricity. It consists of a plate of vulcanite, about one third of an inch thick, and about half the size of a page of the SCIENTIFIC AMERICAN. One or more small pieces of tin foil about the size of a playing card are pasted on one side of this plate. The vulcanite electrophorus produces electricity with remarkable facility. It is placed on a table, and the surfaces are successively rubbed with the palm of the hand. If the plate is raised from the table and the tin foil is approached by the other hand, a spark from one third to four fifths of an inch long is produced. A number of figures of elder pith complete the toy, and show the phenomena of electrical attraction and repulsion in the most comical manner. The plate being excited, the small elder pith figures are placed on the tin foil, and the plate is lifted from the table. One of the figures will raise its arms, the hair of another will stand out like the bristles of a porcupine, and the third, which is to be lighter than the rest, will perform very laughable movements, and will seem to play with the two pith balls.

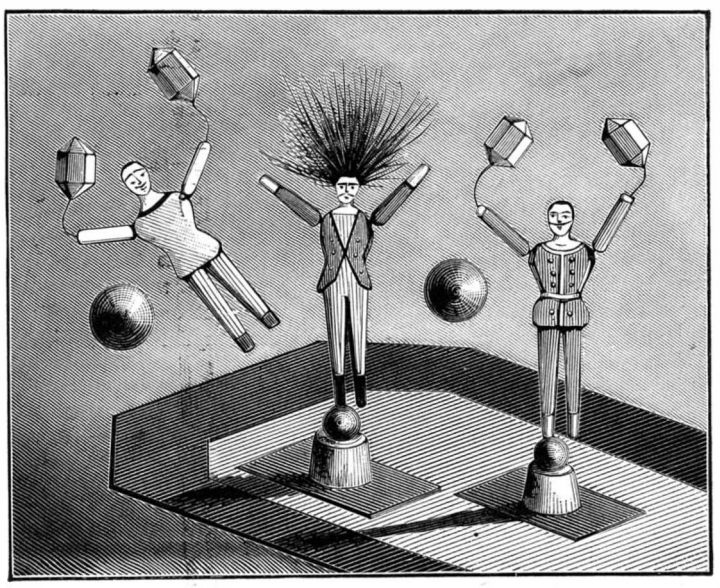

Fig. 1.—ELECTROPHORUS WITH ELDER PITH FIGURES.

Fig. 2 shows electric bottle imps, made by Mr. De Combettes. A cylindrical glass vessel is filled with water, and mounted on a hollow base containing an electro-magnet provided with battery connections. One or two small figures, surmounted by a hollow glass bulb, and having a small piece of wire attached to the feet, are placed in this vessel. The air in the hollow glass bulb will draw them up to the surface of the water, as shown in one of the accompanying engravings, but as soon as the current is passed through the electro-magnet, the figures will be drawn down to the bottom of the vessel. As soon as the current is interrupted the figures will rise rapidly.

The magic fishes, shown in Fig. 3, resemble the device just described. The electro-magnet is replaced by a small electro-motor which rotates from right to left or from left to right, and causes a corresponding movement of the fishes in the vessel.

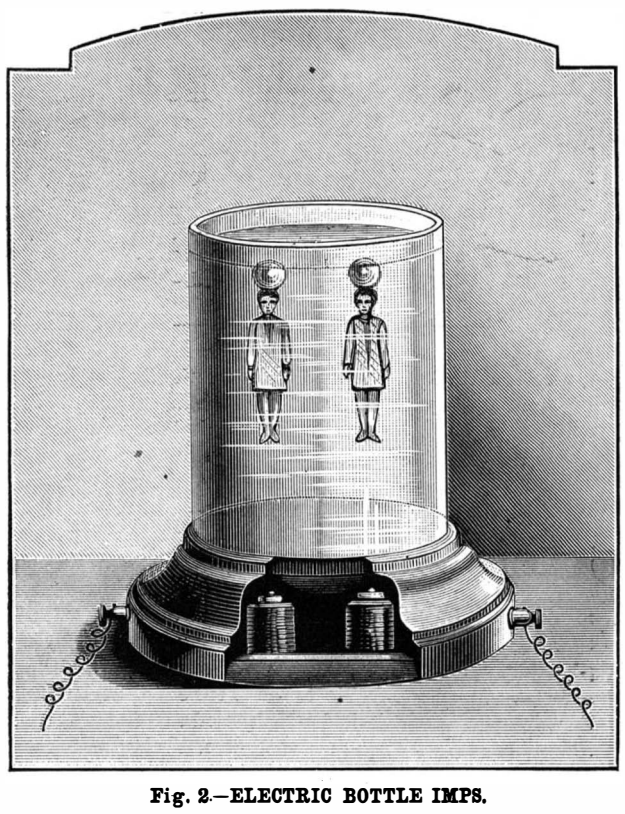

Fig. 2.—ELECTRIC BOTTLE IMPS.

RECENT INVENTIONS.

Mr. Hosea Willard, of Vergennes, Vt., has invented a novel scale beam, the object of which is to facilitate the weighing of articles on the same scale by different systems of weighing—as, for instance, by the ordinary avoirdupois system and metric system, by avoirdupois and troy weights, net and gross weights, etc.

Mr. Michael H. Hagerty, of Brooklyn, N. Y., has patented a glass stopper for milk bottles and other similar articles with a metal eye for the reception of the bail by which the stopper is fastened to the bottle. The stopper has a central depression in which is a metal eye, the shank of which is moulded into the glass stopper in the center of the depression.

Mr. Andrew D. Martin, of Abbeville, La., has patented an improved saddle blanket, which is light, cheap, and durable. The blanket is woven on a hand or machine loom, with strands twisted out of black Spanish moss. The warp is of sufficient length for a number of blankets, and the weft is interwoven with it, and the blankets are cut off at the desired length when completed. A strand of cloth is woven in between the weft at the ends of each blanket, and one or more strands of cloth or some similar material, are woven into the middle of the blanket. The edges of the blanket are trimmed with a binding of cloth, leather, or oil-cloth.

Mr. William H. Allen, of New York city, has invented an improved machine for weighing grain and other substances as they flow from a spout, discharging them in uniform quantities into a hopper or other receiver, and registering the weight of the substance discharged.

An improvement in washing machines, patented by Mr. George W. Dorris, of Elgin, Texas, consists in combining a lower cylinder having longitudinal spiral grooves with an upper cylinder having longitudinal straight grooves and holes.

An improved apparatus for refining camphor has been patented by Mr. William V. McKenzie, of Rahway, N. J. The method of using this apparatus consists in placing the crude camphor upon the diaphragm in a suitable covered vessel, and introducing steam of proper temperature from a boiler into the chamber below the diaphragm to cause the camphor to evaporate or sublime. The moisture or a portion of it contained in the crude material passes off as steam through an aperture in the cover, while the camphor sublimes or evaporates and collects upon the under side of the cover in a solid cake that may readily be removed by slightly heating the cover. The impurities of the camphor remain behind on the diaphragm.

A safe, easily-operated, and strong device for fastening the ends of the traces to the single-tree, has been patented by Mr. Millard M. Bowlus, of Bowlusville, O. The device consists of a flat metal spring attached to the back edge of the single-tree, and provided with a notch which receives the edge of the end of the trace, and, together with an adjacent notch in the single-tree, holds the end of said trace on the single-tree.

Mr. Dennis Harrington, of New York city, has patented a device for transporting or moving live stock on foot through the streets of a city. It consists of a pen without a floor, mounted on wheels, and arranged to be drawn forward by animals. By this arrangement stock can be moved through the streets of a city with perfect safety to the inhabitants, as it is impossible for the animals to escape from the moving pen.

Messrs. Samuel Mart, of Sutton-at-Hone, County of Kent, and Charles W. Bradley, of York Street, County of Surrey, England, have patented apparatus for heating or cooling water and other liquids wherein the water is circulated in tubes within a heating or cooling space and drawn through a pipe as desired for use. In heating water the inventors make use of gas burners to which the gas is turned on when required by a cock, which also supplies gas to a pilot burner that burns continuously to maintain the heat and keep up a circulation. The gas cock is combined with the water supply pipe in such a manner that a single handle is made use of for regulating the gas supply, the supply of water to the boilers, and the delivery of the hot water. The hot water is delivered by a rising pipe above the heater, into which the hot water is forced by the pressure when the water inlet to the heater is opened. In cooling water, ice is substituted for the burners.

An animal poke, patented by Mr. James T. Camp, of La Fayette, O., consists of a bow to place over the animal's neck, in which are pivoted the ends of two bars, one above the other. The pivoted ends of the bars are provided with cams, so arranged that by pressure on the lower bar the poke is spread open. The free end of the lower bar, when it is drawn down, throws the free end of the upper bar up against the head of the animal.

Mr. George W. Ebright, of Waynesville, O., has patented a new, simple, and amusing toy, consisting of a box containing a slide provided with a rubber or other suitable spring. To this slide a goat or other animal is fastened, which, when the spring is pulled, butts against the figure of a boy on the front part of the box.

Mr. Washington Irving Marsh, of Northville, Mich., has patented a device for preventing the ends of the whiffletree from catching upon or striking against any objects. It consists of a plate of wood or metal attached to the trace of a harness just in front of the cock-eye, and extending rearward past the hook and end of the whiffletree.

Messrs. James W. Gault and William A. Forman, of Murphysville, Ky., have patented an improved elevator for hoisting tobacco plants and leaves and suspending them upon the rails in drying or curing barns. This device can easily be worked by one person, and by it the tobacco sticks can easily be hung six inches apart, or closer, if desirable, thus economizing all the hanging room in a curing barn.

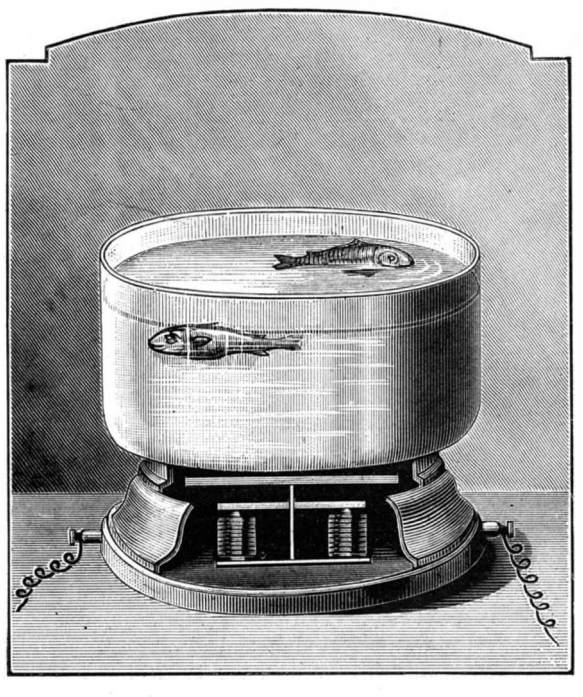

Fig. 3.—MAGIC FISHES.

Mr. John H. Yates, of Sharon, Wis., has invented an improved nasal inhaler, which is simple, convenient, and so arranged that the air can circulate very freely through it before being inhaled. The invention is an improvement on the inhaler for which letters patent No. 167,209 were granted to Mr. Yates and Mr. Charles R. Treat, dated August 31, 1875.

Mr. John Toler, of Newark, N. J. has patented an improved furniture caster. The object of the invention is to provide a solid bearing in a two part caster socket for the conical head of the caster spindle, and to secure the spindle in said two part socket without the use of screws or rivets.

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A simple and effective bag tie that cannot accidentally become unfastened, has been patented by Mr. Moses Y. Hall, of Vinal Haven, Me.

Mr. Johnson H. Beard, of Providence, Ky., has patented a portable fireplace that is self-supporting when it is set up, and does not require external support to give it stability.

Mr. Henry Shulenbarger, of Smithville, O., has patented an animal trap that will catch the animal before it has an opportunity to eat the bait, and will also set itself automatically after being sprung.

Mr. Michael Limpert, of Pittsburg, Pa., has patented an improved heating attachment for cars and other vehicles, so constructed as to heat the floor of the vehicle and at the same time introduce a supply of warm fresh air.

Mr. Alfred N. Loveiace, of Knoxville, Tenn., has patented a trap for the flies, moths, and other insects that are destructive to bees and to vegetation, and that produce the larvæ destructive to tobacco, cotton, etc.

Mr. Ezra W. Savage, of Ashtabula, O., has patented an improved sap spout, by which the sap bucket may be held to a tree without injury to the bucket. It consists of a latch pivoted to the front end of the spout and a hook formed on the under side, so that by the combination of the two a sap bucket may be firmly held.

Mr. Morris F. Bell, of Fulton, Mo., has patented an improved adjustable rocking chair. The seat and back of the chair are continuous, and composed of thin transverse strips of wood or other suitable material, riveted on two or more longitudinal flexible bands of metal. One end of these bands is secured to the head piece, while the other is fastened to the front piece of the seat. Thus both back and seat are made flexible and capable of conforming to the shape of the occupant.

A self-closing bottle stopper, patented by Mr. James J. Allison, of Nelson, Ill. consists of a wire doubled to form a median loop or eye, and provided with elastic arms passing through stopper and having hook ends bent toward each other.

Mr. Louis B. Denison, of Delaware, O., has patented a tripod head for leveling instruments. In this device there are two sets of leveling screws, and the motions produced by them are independent of each other, so that when the instrument is leveled over one set it remains so while being leveled over the other set. By this independence of motions the binding of the leveling screws, that is so common with ordinary tripod heads, is entirely obviated; and as the binding of the screws is a source of a great deal of trouble to the operator in many ways, both because of the consequent breaking of the screws and because of the straining of parts of the tripod head, the entire removal of such troubles by the use of this device will recommend it to all who use leveling instruments.

Mr. James N. Winn, of Darien, Ga., has patented car couplings which are so constructed that they may be moved up and down to adapt them to couple with cars higher or lower than those to which they are attached.

Mr. John Kirkland, of Menomonee, Wis., has invented an improved spark arrester of the class in which plates, disks, or other devices are placed within the smoke stack for the purpose of detaining the sparks and cinders until they are consumed or extinguished.

An improved cloth cutting knife for cutting several thicknesses at the same time, has been patented by Mr. Nathan Rubenstein, of Chicago, Ill. The invention consists in a knife, the cutting edge of which is inclined downward toward the center of the blade and is then inclined upward to the lower end of the blade in a wave line, thus forming a shoulder at about the middle of the cutting edge.

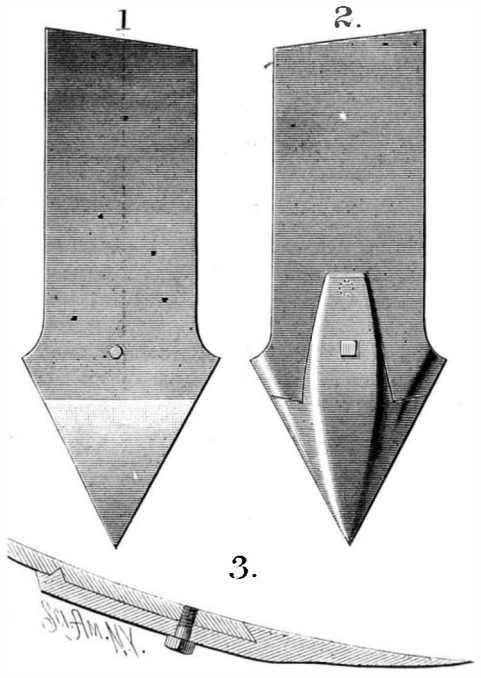
Mr. John M. Axtmann, of New York city, has patented a new and improved attachment for transoms, by means of which they can be conveniently opened and held in the desired position. It consists in a curved lever pivoted to a bracket secured to the door frame, and having one end pivoted to a pitman rod provided with a handle or knob, and the other end provided with a stud which passes into a slot in an angle plate securely attached to the hinged or pivoted transom.

The Industrial Population of France.

According to the *Annuaire Statistique* recently published by the French Minister of Agriculture and Commerce, the total population of France, a little under 37,000,000 in round numbers, is divided into 12,000,000 inhabitants of towns and 25,000,000 inhabitants of the country. On eliminating from the general total 860,590 individuals (who are soldiers, sailors, students in schools, infirm and diseased, prisoners, or monks not giving instruction), the total of a little over 36,000,000 of persons participating fully in social life comprises, with regard to means of existence and professions, 210,200 persons without known professions; 71,300 vagabonds and mendicants; 2,151,900 stockholders (including 195,000 pensioners of the Government); 1,531,400 persons exercising liberal professions or living by them; 3,837,200 persons engaged in trade, transport, and navigation, or living on their products; 9,274,500 persons engaged in various industries, or living by them (6,000,000 in small industries, 3,000,000 in mining and manufactures); 18,968,600 persons practicing agriculture, or living by it (of whom 10,500,000 are proprietors of their land, nearly 6,000,000 are tenant farmers, 2,500,000 are agricultural specialists, comprising vine growers). On entering into detail of each of the great branches of the national production, it is found that 4,000,000 of proprietors or agricultural tenants (of whom 400,000 are women) employ: as clerks, 82,000 men and 54,000 women; as workpeople, 590,000 men and 378,000 women; as day laborers, 922,000 men and 704,000 women; as domestics, 661,000 men and 663,000 women; and, on the other hand, that the families maintained by the landed property or agricultural work consist of 3,800,000 persons of masculine sex, and 7,200,000 of feminine; 1,125,000 industrial patrons (of whom 226,000 are women) have for clerks 143,000 men and 50,000 women; 1,555,000 workmen and 1,000,000 workwomen; 305,000 male day laborers and 244,000 female; 78,000 male domestics and 143,000 female. The families living by industrial operations embrace nearly 1,600,000 persons of masculine sex and 3,000,000 of feminine; 784,000 employers in trade and carriage (of whom 221,000 are women) have 247,000 male *employés* and 71,000 female; 198,000 workmen and 56,000 workwomen; 140,000 male day laborers and 80,000 female; 65,000 male domestics and 188,000 cooks or nursery maids. They support families amounting to 661,000 boys and 1,346,000 girls.

IMPROVED SHOVEL PLOW POINT.

The profits of the agriculturist depend largely on the perfection and adaptability of his implements, and it is not only necessary that the implements be perfect as they are purchased, but they should be so designed that worn parts may be readily adjusted or replaced so that only a small portion of the original expenditure will be required to make the tool "as good as new."



BEEBE'S SHOVEL PLOW POINT.

The invention represented by the accompanying engraving is intended to render a very important class of agricultural tools more useful and more durable than those of the usual construction. Fig. 1 is a face view of the share, having the point attached; Fig. 2 is a back view, and Fig. 3 is a longitudinal section showing the joint between the share and point. The point, as will be observed by referring to Fig. 3, is hooked over the beveled end of the share and is held firmly in place by a single bolt and by a short dowel pin. The point may be readily removed and replaced when worn or broken, at a cost that is slight when compared with that of the entire shovel, and when the point needs sharpening it may be removed and sharpened without injuring the temper of the share.

It is stated that in the long run this share with its point is much cheaper than the ordinary kind, and is capable of doing better work. It may be adapted to local peculiarities of soil and to different kinds of work.

Mr. H. C. Beebe, of Canton. Fulton county, Ill., is the inventor of this useful improvement.

Wheat Heaters.

Perhaps no device has come into such wide use among our millers, in so short a time, as our steam wheat heaters. A very short time ago the heating of wheat by steam was almost or altogether unknown, while now hundreds of mills are using them, and scores are sold every week. An unsophisticated person, on entering a mill and finding the wheat heated to a very moderate degree, but little above blood heat, in fact, might have serious doubts as to whether any advantage was gained by the procedure; but the experienced miller's observation has taught him that the benefit derived from heating wheat by steam is of a very substantial character.

Hard, dry wheats have always been difficult to mill properly and still obtain a good yield. In grinding such wheats, if the outer covering is dry and brittle, it cannot well avoid being abraded more or less, and the tiny particles of bran rubbed off in the grinding are so thoroughly mixed with flour that a separation is impossible, seeing that the comminuted particles of bran are of about the same size as the flour particles, and will pass through the same numbers of bolting cloth. It was this observed fact that led millers to adopt some means of toughening the bran before grinding, and the first and simplest means seemed to be to wet it. This practice is still largely followed by European millers, but there are very serious objections to it, not the least of which is, that wetting the wheat spoils the keeping properties of the flour. Some genius noted the fact that dry, hard wheats could be ground and bolted more easily in hot weather than in cold, and reasoned that the only reason could be that the wheat was warmer. Of course this would seem paradoxical, for on first sight it would appear that the original trouble with the wheat was, that it was too dry, and that any more heat would make it still drier, and therefore more unsuitable for milling. A little reflection will show, however, that additional heat, while drying out the interior of the berry, draws the moisture to the surface or bran, and therefore attains the purpose of wetting the wheat while avoiding the disadvantage of the latter; for by drawing the moisture to the bran, the "keeping" properties of the interior portion of the berry are enhanced.

The advantage of using wheat heaters is manifold. One great object gained is, that the wheat is ground and bolted at about the same temperature the year round, and trouble and annoyance with the bolts is largely or completely avoided. The toughening of the grain coating renders broad bran possible, and therefore the flour will have fewer specks. Most millers agree that there is an appreciable saving of power in grinding wheat that has been previously passed through a heater, and another advantage which very many have noticed is, that when heated, hard and soft wheats blend more easily in grinding. All these things are certainly sufficient to entitle the wheat heater to a permanent place among our mill machinery, and account for the large numbers of them that have been sold in the past two years.—*American Miller.*

Sun Spots.

The sun is becoming an object of great interest to observers, as the minimum sun spot period is drawing to a close. During the greater part of the winter spots have been visible on the sun's face. An observation made yesterday revealed three widely separated spots or groups, forming an immense triangle. Two of these spots were quite large, and surrounded with broad penumbræ. These spots were very black. The presence of spots on the sun can be easily acertained without danger to the eye, by those possessing telescopes of even moderate power. Let a broad, round, pasteboard screen, with a hole in the center for the eye piece to pass through, be attached to the telescope. In the shadow of this screen, and about two feet or eighteen inches from the eye piece, place a white paper screen. The screen can be supported by a very simple contrivance, so it shall be nearly at right angle to the telescope tube as directed to the sun; or a paper may be pinned to the side of a building, if no great accuracy is desired. An eye piece mganifying from twenty to a hundred diameters is best for the purpose. Throw the sun's image on the screen so the edge shall appear sharp as it crosses the field of the telescope. The dark spots which move across the screen with the sun's image can be readily detected and carefully focused, so their full outlines will appear, provided the magnifying power is sufficient. This is a safe way of observing sun spots, and it requires but little preparation. A better way would be to throw the image upon a white surface at the bottom of a funnel. But this funnel must be attached to the telescope, or so mounted as to move with it in following the sun. An equatorial mounting is the best for the purpose. The eye piece should be mounted in brass, as rubber or other light material is liable to take fire. By the use of a low power eye piece the telescope may be readily placed upon the sun. This accomplished, a higher power may be applied.—*Rochester Democrat.*

Theory of Life.

The late Professor Faraday adopted the theory that the natural age of man is 100 years. The duration of life he believed to be measured by the time of growth. In the camel the union takes place at eight, in the horse at five, in the lion at four, in the dog at two, in the rabbit at one. The natural termination is five removes from these several points.

Man being twenty years in growing lives five times twenty years—that is, 100; the camel is eight years in growing, and lives forty years; and so with other animals. The man who does not die of sickness lives everywhere from 80 to 100 years. The professor divides life into equal halves—growth and decline—and these into infancy, youth, virility, and age. Infancy extends to the twentieth year, youth to the fiftieth, because it is in this period the tissues become firm, virility from fifty to seventy-five, during which the organism remains complete, and at seventy-five old age commences to last a longer or shorter time as the diminution of reserved forces is hastened or retarded.

Winter Cotton in Georgia.

The turn out of the cotton crop of this region is simply astonishing. Many farmers are now gathering several hundred pounds a day. It seems as if every boll will open. The mild weather of the winter has been a godsend on this account, for it has given every farmer many more bales than he thought it possible for him to get at the beginning of the season. We heard one man say he had lost three bales by plowing up a field too soon to sow in wheat. It is a novel sight to see cotton picking going on the last of January. The cotton is stained and classes low, but it pays better than the good grades did last year.—*Oglethorpe (Ga.) Echo.*

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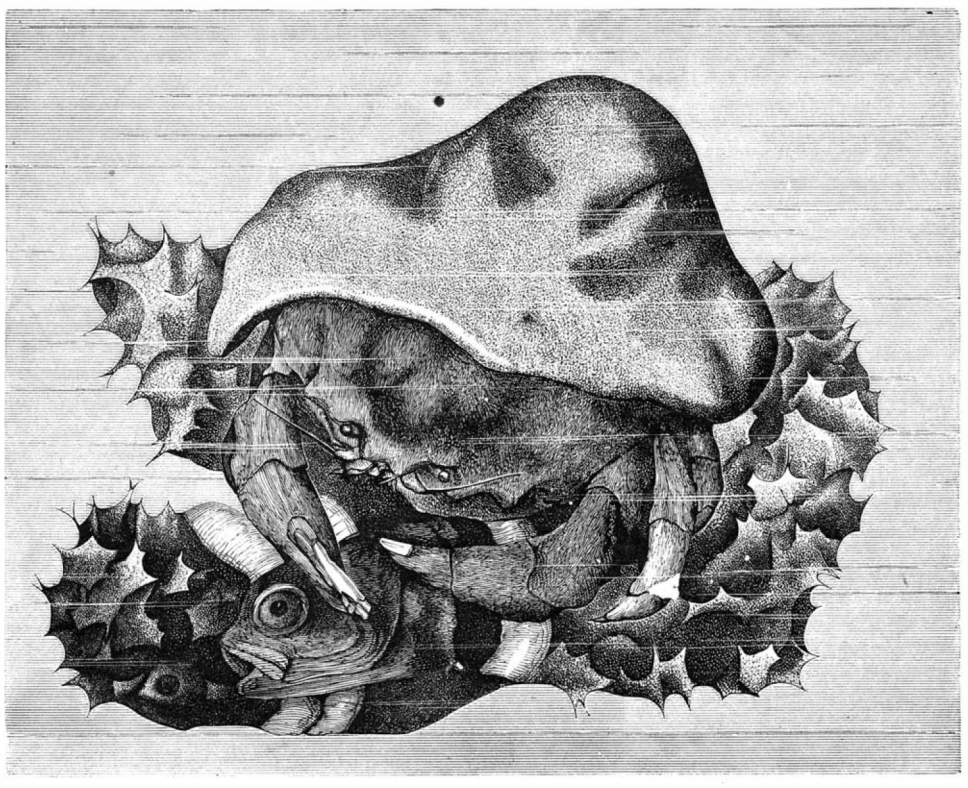
THE HAIRY CRAB.—(*Dromia vulgaris.*)

This crab belongs to a class which forms one of the connecting links between the crab and the lobster. The last pair of legs are perfectly useless for walking, and are modified into a pair of appendages by means of which the animal is enabled to cling to an object very firmly. The body is covered with hairs, generally filled with such a mass of seaweeds and dirt that it requires a good washing to show the real color of the animal. The peculiar habit of this crab is to drag along some kind of sponge, generally a *Tragus spinosulus* or a variety of *Suberites domuncula*, on its back, and to hold it by means of the deformed pair of legs. It uses this sponge to conceal itself, and only drops it when pursued.



HAIRY CRAB (*Dromia vulgaris*) COVERED BY A SPONGE (*Suberites domuncula*), NATURAL SIZE.

The Touracou.

This curious bird, the touracou (*Turacus albocristatus*), is one of the plantain eaters. This bird has bright red feathers in its wings, the red coloring matter of which is soluble in water, so that the birds are apt to wash their red feathers white when in confinement. The coloring matter, "turacin," as was discovered by Prof. A. H. Church,* is distinguished by yielding a remarkable absorption spectrum, and contains a considerable quantity of copper.

The bird is very common in the Kuys-na, and I was told by sportsmen who had shot it, that in rainy weather it will hardly fly, but crouches down under the bushes, and may sometimes be knocked down with a stick.

A most extraordinary statement concerning these birds, to the effect that the red color, when washed out of the feathers, becomes restored, is made by M. Jules Verreaux.† It seems impossible to understand how this can happen, since there seems no means by which the coloring matter can be conducted from the body of the bird to the web of the feather.

Such a result seems only possible in hornbills, some of which, as is well known, paint their feathers yellow by rubbing in a yellow secretion discharged from glands under the wing. M. Verreaux states that in rainy weather, just as I was informed, the touracous get their feathers wet through, and are, in consequence, unable to fly, but crouch on the ground, instead of resting on the tree tops as usual. He caught several with the hand; the color came out on his hands from the wet feathers. He washed the color out of their wings with soap and water till the feathers were almost white. The bright red color, however, returned directly the feathers were dry, and this occurred even when the same bird was washed twice in the same day. The red coloring matter is scarcely at all soluble in pure water, but the addition of the slightest trace of alkali to the water enables it to extract the pigment from the feathers, and yield a blood-red solution.—*H. N. Moseley, Challenger Notes.*

Sugar Beet Industry in Delaware.

The Legislature of Delaware in 1876 appropriated $300 toward the encouragement for the growing sugar beets within the State, and subsequently increased the appropriation to $1,500, and a commission of three well known citizens of the State were appointed to disburse the appropriation by offering premiums to the growers of beets, and otherwise promoting the new industry. To this end the commission obtained pure imperial sugar beet seed from abroad, which they distributed to farmers who desired to raise them. With the seed were furnished documents containing instructions as to the character of the soil needed and its preparation, the time of planting, cultivation, and harvesting, also copies of the following conditions as the principal ones to be observed: "Select a suitable soil; use fertilizers or well rotted manure; deep plowing in the fall or early spring; straight rows, close together, and plenty of seed; early and frequent working and careful thinning to one beet in a place; place one beet to every 120 or 200 square inches, which will give from 30,000 to 50,000 beets per acre, which, in rich land, will weigh from 1 to 2 pounds each."

The action of the commission induced a large number of farmers in Delaware to commence the culture of the sugar beet as an experiment, and premiums were awarded for the growth of 1878 to twenty-two farmers in Kent county, ten in New Castle county, and one in Sussex county. The reports from the various parties contain a description of the soil, the time of plowing, and the mode of cultivation. The premiums for the growth of 1879 were $100 for the best one acre and upwards grown under contract; $75 for second best; $50 for the third, and $25 for the fourth. This action of the commission stimulated the farmers, and, according to the Philadelphia *Ledger*, from which we derive our information, during the past year from 75 to 100 of them, principally in Kent and New Castle counties, cultivated the beet with as to absorb its impurities. Carbonic acid gas is then introduced to precipitate the lime, after which the production is run through bone-black to clarify it. From these tanks the juice is passed to a steam pump, where it is forced to the filter presses, which still further extract impurities. From here it is conveyed into the vacuum pan, where it is concentrated almost to the crystallization point.

After having passed through this process, the juice is placed in iron wagons and run into a room with a temperature of about 125°, where it remains from four to five days, when it is ready for the last process, which consists in passing the juice through a centrifugal machine. This revolves at the rate of 1,500 revolutions per minute, and from one end runs the molasses or sirup, and from a box a dark yellow substance, known as raw sugar, is taken, and which is sold to the refiners.

The capacity of the present works is 25 tons of green beets per day, but it is expected to increase them to 200, as the cultivation of the beet increases throughout the State. The product so far has been from 8 to over 18 tons per acre, and the price realized was about $4 per ton. After extracting the sugar from the beet, the pulp is sold to farmers at $1 per ton, and used by them as food for cattle. The only other establishments now making sugar from beets is one in Maine and one or two in California.

* Researches on Turacin, "Phil. Trans.", 1870, p. 627.
† M. Jules Verreaux, "Proc. Zool. Soc." 1871, p. 40.

Fast Horses.

The running horse in this country is not so valuable as the trotter. Pierre Lorillard paid $18,000 for the famous runner Falsetto, three years old, recently sent to England. Mr. Keene paid $15,000 for Spendthrift. When we come to the trotters we find the prices up. Mr. Bonner paid $40,000 for Pocahontas, $36,000 for Rarus, $33,000 for Dexter, $20,000 for Startle, $16,000 for Edwin Forrest, and $15,000 for Grafton. Mr. Smith, of New Jersey, paid $35,000 for Goldsmith Maid, $32,000 for Jay Gould, $30,000 for Lady Thorne, $25,000 for Lucy, and $17,000 for Tattler. Mr. Vanderbilt paid $21,000 for Maud S., and $10,000 for Lysander Boy. The largest sum ever paid for a horse in England, where they have few trotters, was close on to $72,000, paid for Doncaster by the Duke of Westminster.

New Method of Extracting Plant Perfumes.

The *Revue Industrielle* states that M. Camille Vincent, who has already created two industrial applications of the chloride of methyl derived from the residue left in the manufacture of beet sugar, has, in conjunction with M. Massignon, discovered still another. Seeing that this substance had the property of dissolving fatty bodies, resins, and essential oils, these gentlemen were led to consider why it might not be made available for the extraction of the odoriferous principles of plants. The first experiment, made upon odorous woods, was successful, but gave a product which had a disagreeable smell, owing to the fact that the commercial chloride of methyl employed contained traces of a pyrogenous matter with a very persistent odor. M. Vincent, therefore, purified the methyl by means of concentrated sulphuric acid, and obtained a product entirely free from disagreeable odor, and having the property of dissolving perfumes and giving them up again, on evaporation, with all their fragrance. A trial was made with orange flowers in a glass apparatus, and a product obtained which was asserted by several perfumers to be much superior to the neroli obtained by distilling the flower with steam. After these first encouraging experiments, an apparatus of modest size was constructed for the purpose of ascertaining the industrial value of the new treatment by operating at one time on several pounds of flowers and different plants. This apparatus, which has now been working with great regularity for several months, consists of: (1) A digester in which the plants are placed; (2) a reservoir of liquid chloride of methyl; (3) a closed vessel in which is received the chloride charged with the principles derived from the odoriferous plants, and in which, by means of a pump, the same is vaporized; (4) of a pump for creating a vacuum above the chloride to be vaporized, and for compressing the vapor into a serpentine liquefier, from whence the liquefied chloride returns to the reservoir. The latter portion of the apparatus is the same as the ice machine of which we have already spoken in a previous number. In extracting the perfumes, the digester is filled with the flowers, the apparatus is closed, and then by means of a faucet the liquid chloride is allowed to flow into vessel No. 2. Here digestion is allowed to take place for two minutes, and the liquid loaded with the perfume is drawn off into vessel No. 3. Then a new charge of chloride is passed over the flowers, and this is repeated several times. Finally a vacuum is created in the digester to remove the chloride which has taken up the perfume, and it is forced into the liquefier; then a jet of steam is passed through the exhausted mass in order to drive off the chloride which is retained by the small quantity of water contained in the flowers, and the damp gas is collected in a gasometer. The liquid charged with perfume and contained in vessel No. 3 is evaporated in a vacuum. On opening the vaporizer at the end of the process, the perfume is found, mixed with fatty and waxy matters. This mixture, treated with cold alcohol, gives up the perfume with all the fragrance and sweetness that it possessed in the plant. M. Massignon's works are prepared to treat 2,200 lb. of flowers per day. This new manufacture makes the third industrial application of chloride of methyl (as before stated), the other two being the manufacture of methylated products and the production of ice.

THE PHYLLOXERA IN CALIFORNIA.

It appears from an article in Prof. Riley's new journal, the *American Entomologist*, that the phylloxera has established itself in the Sonoma Valley of California, and destroyed hundreds of acres of vineyards, while only a few miles distant, in the most important wine district of the State—the Napa Valley—not a single case of phylloxera has been detected. "It is," remarks Prof. Riley in commenting on this singular fact, "fortunate for the California grape-grower that the insect has, to all appearances, there undergone a considerable modification in habit, which very much limits its destructiveness. It is steadily spreading from infected centers, but very slowly indeed, compared to its spread in France. Prof. E. W. Hilgard writes that he believes this is due to the non-appearance of the winged female, as he has not been able to obtain it. If such is the fact it is one of the most curious modifications in habit, as a result of climate, that is on record, and will go far to explain the immunity in the Napa Valley while the Sonoma Valley is being ravaged, and the fact that the insect has not appeared in other parts of California. It also offers an additional incentive to grape-growers in other sections of the State to exercise the utmost vigilance to prevent the introduction into their own locality of infested vines or cuttings. That the species may exist for an indefinite time without the winged female seems highly probable from the fact that the sexual individuals may be produced from hypogean females as well as from aerial ones. Yet so singular a change in the insect's nature can only be accepted upon the most thorough and satisfac-

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tory evidence. This is easily obtained by half filling large glass jars with badly infested roots, interspersed with a little soil, about the time or some time before the grapes begin to ripen. If there are pupæ upon such roots the winged females will soon begin to appear on the side of the jar toward the light."

One of Prof. Riley's correspondents, who has large interests in Californian grape culture, and who has recently recently returned from an extended visit to the richer wine producing sections of the State, says that the insect has been established in the Sonoma Valley for the last five years, and is now working there with terrible effect. No one in this valley seems able to give any suggestion as how the pest may be successfully fought. Every variety of vine planted in the valley has been attacked and destroyed, or is being destroyed.

ENGINEERING INVENTIONS.

Messrs. John Maguire and William A. Alexander, of Mobile, Ala., have patented improvements in vessels and apparatus for river and harbor dredging, wherein pumps are made use of for elevating the material from the bottom. The inventors make use of a vessel of suitable dimensions, formed with a central well and water ballast compartments, whereby the vessel may be sunk to the bottom. The vessel is also fitted with pumping apparatus, whereby the water in the space inclosed by the well is first to be pumped out, and the mud, sand, etc., of the bottom then pumped out to the desired depth. Within the well of the vessel is a frame fitted for being raised and lowered, and carrying discharge nozzles of a second pumping apparatus, whereby streams of water are discharged for agitating the mud, etc., and rendering it semi-liquid, so that it may be pumped out. These discharge nozzles are fitted upon carriers that are movable upon slideways, whereby all portions of the inclosed bottom may be subjected to the action of the water.

Mr. John H. Wait, of Opelika, Ala., has patented an automatic railway switch, that may be operated by the wheels of the passing locomotive, or by means of levers attached to the locomotive or one of the car trucks. The invention consists in a combination of pivoted rails, levers, and locking devices, which cannot be fully explained without engravings.

An improved process and apparatus for sinking piles has been patented by Mr. Henry Case, of Brooklyn, N. Y. The object of this invention is to sink piles for submarine or other foundations without the aid of pile driving machinery, and to secure good bearings for the piles at proper depths.

An improved car brake and starter has been patented by Mr. John L. Cole, of Williamstown, Mass. The improvements relate to apparatus for checking the momentum of railroad cars and storing power to be subsequently used in starting or impelling the car. The apparatus consists, generally, of springs, a cord or chain, a conical spirally-grooved winding drum, and gearing and clutches for connecting the drum with the car wheels or axle, whereby the cord is wound on the drum, the springs compressed and held for use in propelling the car by their expansion. The invention has certain novel features of construction and combination of mechanism by which the propulsion of the car in the proper direction by the springs is obtained and the compression of the springs by the momentum of the car is arrested at a definite point, and the mechanism is automatically thrown out of gear when the momentum is arrested, and also when the springs have expended their force in starting the car. It may also be thrown into and out of gear at any time by the driver.

ARTESIAN WELLS FOR COLORADO.

The Committee on Public Lands has reported favorably the bill introduced by Senator Hill, of Colorado, providing for an appropriation of $50,000 to be used in sinking artesian wells in the arid regions of the Rocky Mountains.

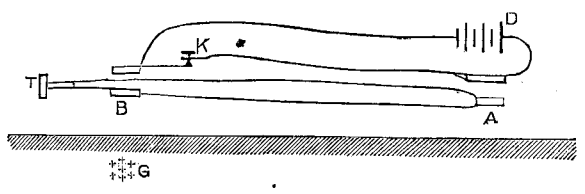
It is estimated that there are in those regions five hundred million acres of government lands, now unsalable because of their aridity, which could be converted into valuable farming lands by irrigation, and that such artificial watering is entirely feasible by means of artesian wells. The government is asked to pay the cost of the experimental proof of this position because it owns the land, and private enterprise cannot be expected to undertake its improvement. It is asserted, however, that having demonstrated the possibility of reclaiming such lands, the government will have no difficulty in selling the land to men who will go on sinking wells at their own cost. Mr. Hill's bill provides for the sinking of five wells, two on the east and three on the west of the Rocky Mountains, the sites to be selected by the Secretary of the Interior.

A New Way of Studying Sounds.

The London *Times* reports that a new and simple way of producing colored rings, which seems capable of some interesting applications, has been recently brought to public notice by M. Guébhard. A saucer filled with not very pure mercury is all the apparatus required. Then clear off with a piece of card or paper the thin pellicle of oxide and dust, breathe on the bright surface, and a magnificent system of colored rings is given by the film of condensed moisture then formed. Instead of the four or five "irises" described by Newton, six or seven can be well made out, and the thickness of the film increasing from the border inwards, the order of hues is reversed. Still better effects can be got by dropping volatile substances (as petroleum oil) on the mercury surface, instead of breathing on it; but the most remarkable results are had with collodion. Diluted with ether, this gives pellicles on the mercury, which may be detached (after their thickness and colors have been regulated at will) and transferred to paper. M. Guébhard has utilized these effects in study of the sounds of the voice. Vowel sounds uttered above the moistened mercury surface produce characteristic ring figures which throw new light on the nature of the vibrations involved. The vibratory state, indeed, for vowel sounds, appears to be often very complex, the figures presenting groups of several ring systems, indicating several centers of percussion.

"Prospecting" Metal Veins by the Induction Balance.

A correspondent of the *Electrician*, referring to the reported invention of a method for detecting and tracing veins and lodes of metals in the earth by means of electricity, says there has been suggested to him the application of the induction balance of Professor Hughes to the purpose. It is well known, he adds, that the balance is extremely sensitive to the neighborhood of metals, and it becomes a question worth settling by experiment whether this sensibility could not be employed as a means of indicating the presence of metalliferous ores underground. The obvious mode of applying the apparatus would be to separate the two induction pans of the balance to such a distance apart that, while one of them was brought under the influence of the concealed metal, the other would be comparatively unaffected. This could be done, perhaps, by elevating the balance vertically on a pole or standard, to be carried about by the prospector, so that one pan was brought near the surface of the ground, while the other was raised above it to a considerable height, say, of ten or twelve feet. On a balance being obtained in a proper locality the search could begin, and the presence of veins under foot might be found to reveal itself by disturbing the balance. A better but more inconvenient plan, from its rendering it necessary to pay out a portable line or wire,



would be to keep one pan of the balance stationary in one place, while the other was being moved about so as to feel for the hidden ores. The latter method is shown in the accompanying sketch, where A is the stationary pan of the balance, and B is the movable pan carried by the prospector; C is a metal lode under the surface, D is the battery, and K is the key in the primary circuit of the balance, and T is the telephone in the secondary circuit.

While moving over the ground the prospector makes and breaks the primary circuit by means of the key, and listens in the telephone for any sound indicating that the equilibrium of the induced currents has been disturbed. Should the balance prove sufficiently sensitive, it can, of course, be used for similar and allied purposes in mining and boring operations, so as to trace the positions and roughly determine the richness of metal veins, ores, and other conducting minerals, such as coal, graphite, etc. The first plan would probably answer best in cases where the metal was at or near the surface, as is the case in "surface diggings."

Job Shops and Slop Shops.

A writer in the Boston *Journal of Commerce* pictures the difference between a well organized job shop and what he terms a slop shop, as follows. The job shop is *sui generis*. While it partakes of the character of those adapted and intended for special productions, it has a character of its own not shared by any other. The various jobs and the frequent make-shifts tend to produce what would seem to the unpractical eye an appearance of disorder, and would convey such an impression, possibly, to the experienced mechanic, who might be unacquainted with the methods and system of that particular shop. But the well arranged job shop has an all-pervading character of order in the seeming disorder, and its workmen waste little time in preparing for emergencies, and are usually ready for any job that comes up.

The slop shop is exactly the reverse in character, and is never just ready for an unexpected job. Its apparent character is its true one. An outsider could just as readily find a missing tool or designate the hiding place of a needed appliance as the proprietor, foreman, or any one of the workmen. The floor is rarely swept; when the debris of work accumulates too much in one spot, it is spread by a few hasty kicks, and all is serene. There are "glory hole corners" under the benches which rarely are overhauled. There are hiding places for spoiled jobs which are inquired for by the vexed foreman, but rarely found. The shafting welcomes the visitor with a beseeching squeak, the repetition of which finds an echo in the chafing of a lathe belt on the cone. Some of the belts show angular gaps across their face, premonitions of sudden partings and telltales of neglect. The workmen are lavish with oil and waste, put new files on cast iron scale, toss a broken tool under the bench, and if they get hold of a decent tool, in decent order, chuck it into their private drawer or locked box. If a drill is wanted for a three-quarters of an inch hole, one sized to thirteen-sixteenths is taken and ground to size. Possibly half an hour after it has been transformed another workman needs it on work for thirteen-sixteenths holes. So the drills can never be kept in sets and sizes, and when account of stock is taken at the end of the year the proprietor wonders what has become of the sets of drills with which he started off so sanguinely and hopefully the preceding January.

This is the general practice in the slop shop. There is no real head to the concern, there are no Mede and Persian rules of order, no sharp, overseeing eye, and no developed and vitalized system. A job that should be drilled under the upright drill is taken to the lathe because the former is in use, and a workman is put to a three hours' job of chipping and filing because another is using the planer. In this shop there is manifested little readiness among the workmen to assist each other, except to help in turning the shop into a "hurrah's nest." If one man knows more than another he will hold on to his knowledge very much as a miser clings to his pennies. The foreman, possibly, gives instruction but grudgingly or with an air of reproof. The slop shop is a good place to leave a job, but it is a poor place from which to get the completed work. The foreman will promise readily enough to-day, but his performance and day of redemption are indefinite.

There are plenty of these slop shops all over the country. It is singular to note that, although the proprietors invariably fail in business, there are about so many all the time; soon as one drops out another is anxious to show how little he knows about the management of a business, and the slop shop is probably a permanent institution.

Hydrocellulose in Photography.

M. Aime Girard has communicated to the Photographic Society of France the following note on the employment of hydrocellulose in preparing photographic pyroxyline: "Whenever cellulose ($C_{12}H_{10}O_{10}$), in any form, is submitted to the action of concentrated acids, it is dissolved, and by taking up two equivalents of water is transformed into glucose ($C_{12}H_{12}O_{12}$). But previous to this saccharification, an intermediate stage may be observed, where only one equivalent of water is taken up, and a new compound is formed to which the formula $C_{12}H_{11}O_{11}$ is attributed. This compound, to which I have given the name of *hydrocellulose*, is not soluble in the acids, and provided that care be taken in the manipulation, it still possesses its original external form; but so soon as it is touched it will be found to have lost all its power of cohesion, and to fall away to an almost impalpable powder. Hydrocellulose possesses a number of chemical properties of its own, but it keeps also some of the properties belonging to ordinary cellulose. Among the latter is its capability of being nitrified by a mixture of nitric and sulphuric acids, and of being by this means transformed into either explosive or soluble pyroxyline. In this way we can prepare either explosive or soluble pyroxyline in the state of a fine powder. The manner of preparing it is precisely similar to that of preparing pyroxyline from cellulose, but in this case the product, when rubbed in a mortar, is at once reduced to an exceedingly fine powder. This powder, dissolved in a mixture of alcohol and ether, gives a collodion whose value to photographers it will be most interesting to ascertain.

"The only difficulty, therefore, is the production of the hydrocellulose. This substance can be obtained from any form of cellulose, but the best for the purpose will be found to be raw cotton in tufts. For effecting the conversion there are three ways: (1) Immersion for several hours in concentrated acids; (2) exposure to the vapors of the hydracids, as hydrochloric or hydrofluoric acid; (3) absorption by a weak acid, and then desiccation. Of these three methods the last-named is undoubtedly the most convenient. Take, then, some fine tufted cotton, and immerse it in a 3 per cent solution of nitric acid; remove it immediately, drain it, and put it in a cloth and wring it well; then pull it out and leave it to dry. If you are pressed for time, you may dry it on a stove at a temperature of 40° to 50°; a few hours will in that case suffice to render the cotton quite friable, and its transformation into hydrocellulose will be complete. But care must be taken not to raise the temperature above the point indicated, or the substance will turn yellow and decompose. When, however, time is no object, let the cotton be well pulled asunder, and then be allowed to dry slowly on a plate in the laboratory or studio at a temperature of from 15° to 20°. By this, the more preferable method, the cotton will, in a few weeks, be converted into hydrocellulose, which, though perfectly friable, will preserve sufficiently its fibrous condition to be easily acted on by the acids that are to nitrify it.

Back Numbers and Volumes.

Subscribers to the SCIENTIFIC AMERICAN will be entered on our books to commence at the date the order is received; but those desiring the back numbers to the commencement of the year will be supplied on their signifying a wish to have them. Last year's volumes may be had in sheets by mail at regular subscription price, namely, $3.20.

THE series of illustrated articles on "American Industries," which was commenced in this journal about one year ago, has proved so acceptable to our readers that it is our purpose to continue the publication of manufacturing establishments until every important industry of the country has been illustrated and described in these columns.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.
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For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Machinist's Tools, Steam Pumps, Centrifugal Pumps, Iron and Woodworking Machinery, Engines, Boilers, and Supplies. O. L. Packard, 87, W. Water street, Milwaukee, Wis.

Wanted—Machine Shop to make Engines, in quantities, by contract. E. E. Roberts, 107 Liberty St., N. Y.

Solid and Opening Die Bolt Cutters, Screw Plates, and Taps. The Pratt & Whitney Co., Hartford, Conn.

The genuine Asbestos Roofing is the only reliable substitute for tin; it costs only about one half as much, is fully as durable, is fireproof, and can be easily applied by any one. H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, are sole manufacturers.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

For Sale.—Two Windmill Patents, and set of patterns for same. None better. F. C. Maxwell, Columbus, O.

For Sale.—Flexible Lumber Patent for Cylinder Laggings. Geo. C. Setchell, Norwich, Conn.

Wanted.—Second-hand Magic Lantern Slides. Give quantity, quality, size, and price. Address Lantern, Baltimore, Md.

Wanted.—Particulars and Proposition for Ice Machine. Box 170, Charleston, Kanawha, Co., W. Va.

For Sale Cheap.—The entire patent for best Egg Beater ever put on the market. See illustration in SCIENTIFIC AMERICAN of February 21, 1880. Address H. C. Mann, Frankford, Pa.

Wanted—Circulars, with prices, from Manufacturers of Small Drop Hammers, that will strike one or more blows and then stop, and always up, with adjustment for heft of blow, and that will give from one to two hundred blows a minute. Must be open on one side for large work. Address Willcox, Treadway & Co., Cleveland, O.

Steam Engines, Boilers, Portable Railroad Sugar Mills. Atlantic Steam Engine Works, Brooklyn, N. Y.

For Sale.—Four Boilers, 100 horse power each, return drop flue: A 1 condition; $1,500 each. 1 Berryman Heater, 42 x 96; A 1 condition; $400. D. L. Einstein, 16 White St., New York.

For Iron Gas Pipe, see adv. on inside page.

Vertical and Steam Yacht Engines. T. B. Pemberton, 276 Water St., New York.

Wanted—A competent Die Sinker. Steady employment. Address E. P., Box 773, New York.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Wanted.—An Oil Mill of the most improved pattern, for the manufacture of cotton seed oil from the seed of the Sea Island cotton. State price and terms. Address Spirit of the Times, Jasper, Fla.

Wanted.—A few sober, industrious Machinists and Moulders. Address H. B. Smith Machine Co., Smithville, Burl. Co., N. J.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 126.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box423, Pottsville, Pa. See p. 125.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Steam Engine for sale very low. See advertisement on another page.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

Mica in sheet and scrap for sale in quantity to suit. Parties using Mica in any form please send for samples. Atlantis Land and Mining Co., Box 2762, Leadville, Col.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 141.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 94.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville N. J.

Silent Injector, Blower, and Exhauster. See adv. p. 141.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 142.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Power Hammers. P. S. Justice, Philadelphia, Pa. p. 77.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Millstone Dressing Machine. See adv., page 142.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 108.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

New Economizer Portable Engine. See illus. adv. p. 108.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 141. Totten & Co., Pittsburg.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Engines repaired without loss of time. L. B. Flanders Machine Works, Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) P. G. asks: 1. With what substance are the porous cups of a Leclanche battery filled? A. With granular black oxide of manganese. Some makers fill them with equal parts of black oxide of manganese and retort carbon. 2. How is hard rubber polished? A. It is first filed or turned into shape, then smoothed with emery paper, then with powdered pumice stone applied with a felt wheel or felt rubber. The final polish is given by fine whiting and water applied with a brush.

(2) L. C. C. asks: How many horse power do you think would be required to propel a yacht at a speed of ten miles per hour, length 25 feet, breadth 6 feet, built after the "Sharpie" model, total weight of vessel and cargo 4,000 lb.? A. From six to eight horse power.

(3) M. F. R. writes: I think of building a small boat, and would like you to tell me what size single engine and boiler I should get. Length of boat 32 feet, 7 feet beam. It is not to be a flat bottom, and I want to put on a stern wheel, as our river will not admit of a screw. What size wheel shall I use, and how wide should the paddles be? A. About 7 inch cylinder and 18 inches stroke; wheel 7 feet diameter and 9 inch bucket; vertical tubular boiler 34 inches diameter and 6 feet in height.

(4) A. L. K. writes: We have here in this city three telephone lines running parallel for four or five hundred feet. Two of them use the Bell telephone, and one the Edison. Now, when they are using the Edison we can hear every word said by listening at either of the other lines, and they are not within two feet or more of each other; that is, the lines do not run any nearer than that. Can you give the reason? A. The effect noted by you is due to electrical induction. An intermittent or vibratory electric current passing over a line will induce a current in a parallel line, even if the two wires be several feet apart. This phenomenon is beautifully illustrated by Hughes' induction balance and sonometer, fully described in SUPPLEMENT, No. 196.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. J. F.—1. Quartz, decomposed hornblende and feldspar. 2 Coccolite in quartz. 3. Mispickle and mica slate. 2 and 3 may carry a small amount of silver. —J. C. D.—It is metallic antimony, worth about 18 cents per lb. in large quantities.

COMMUNICATIONS RECEIVED.

New Copying Process. By E. P. T.
On Sun Spots. By E. E. B.
Another New Copying Process. By E. P. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 3, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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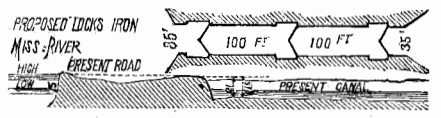

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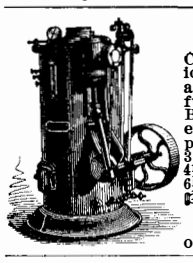

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$4 Self-Inking Printing Press, with complete outfit, **$5.50.** 8 larger sizes. Catalogue and reduced price list free.
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Useful for all work of small stationary steam engine. Built in sizes of **2, 4,** and **7** H. P. by **SCHLEICHER, SCHUMM & CO.,** 3045 Chestnut Street, Phila., Pa. **H. S. Manning & Co.,** 111 Liberty St., N. Y., Agents.

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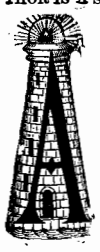

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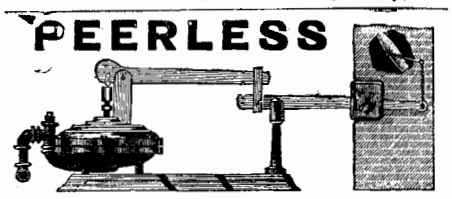

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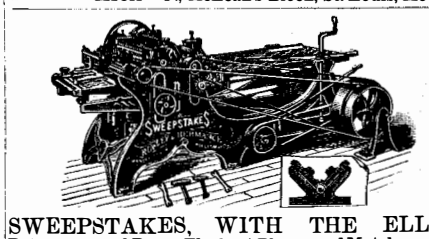

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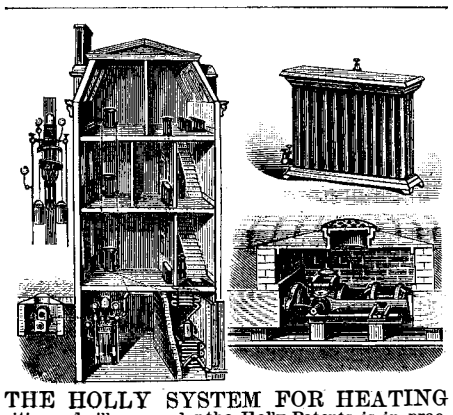

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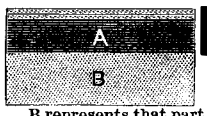

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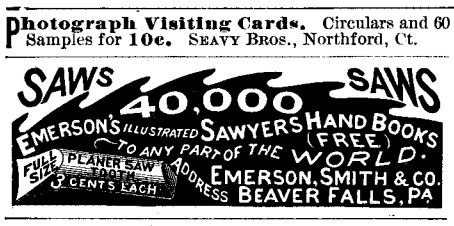
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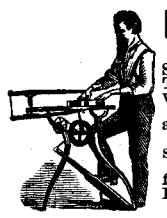

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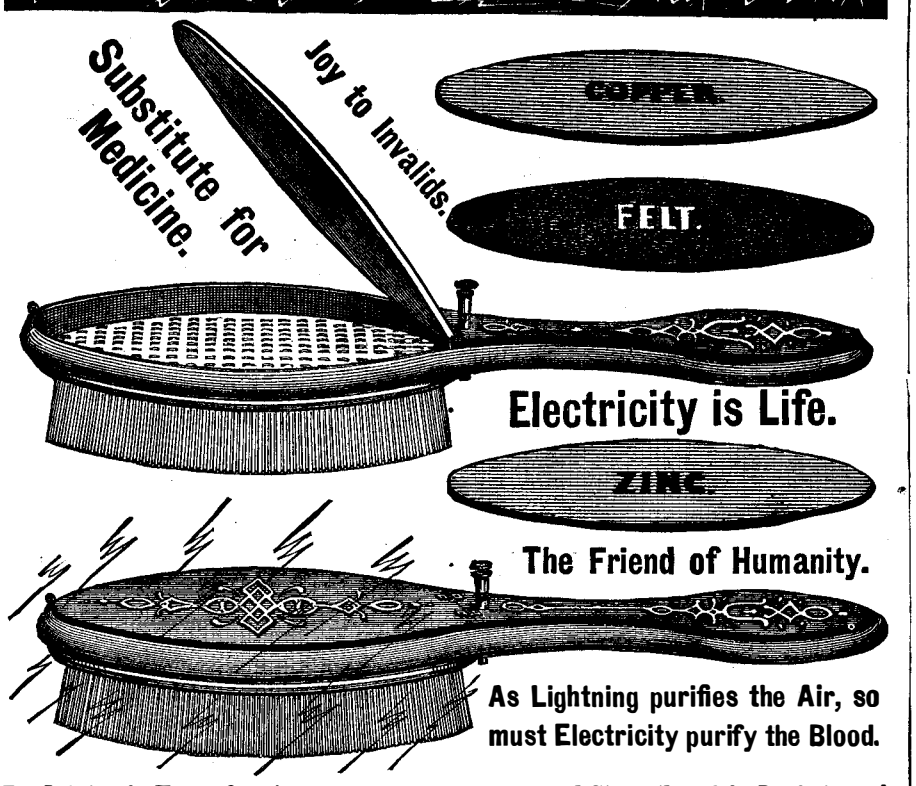

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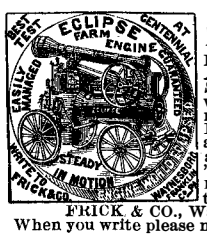

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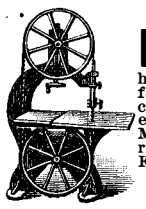

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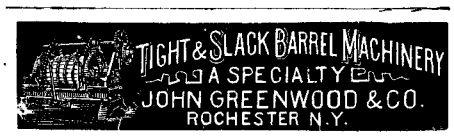

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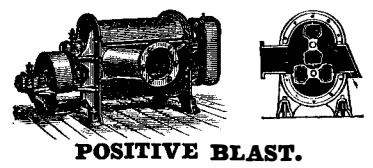

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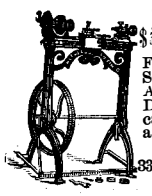

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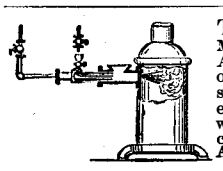

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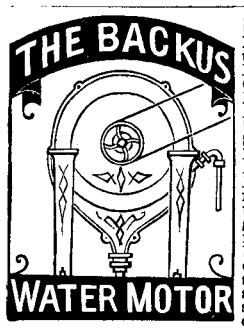

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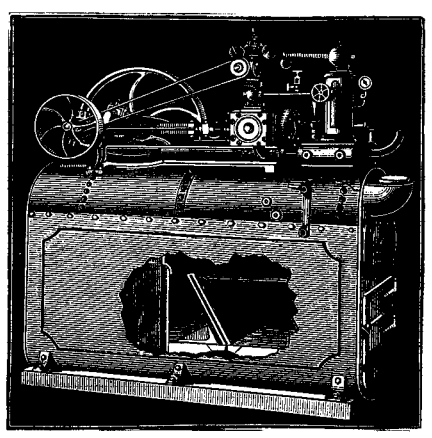

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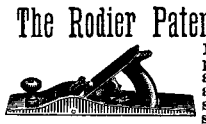

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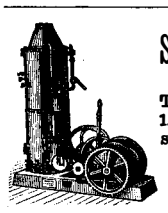

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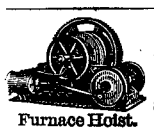

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